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ABSTRACT

Fifty-five papers focusing on the role of computer technology in education at all levels are included in the proceedings of this conference, which was designed to model effective and appropriate uses of the computer as an extension of the teacher-based instructional system. The use of the computer as a tool was emphasized, and the word processor was the tool of interest for this year's meeting. Microcomputers and their applications in teaching mathematics, science, music, drafting, writing skills, graphic arts, and physical education are discussed, as well as such topics as library resource sharing, tessellations, robotics, word processing, networking, keyboarding, and the electronic spreadsheet. Additional papers describe the use of microcomputers to evaluate tests, computer use in education in the USSR, the production of a school newspaper with microcomputers, utilization of demographic data, library classification and cataloging updates of computer related terms, artificial intelligence in education, direct satellite television programming, and computerizing the discipline and attendance offices. A list of figures and a subject/author index are provided. (CGD)

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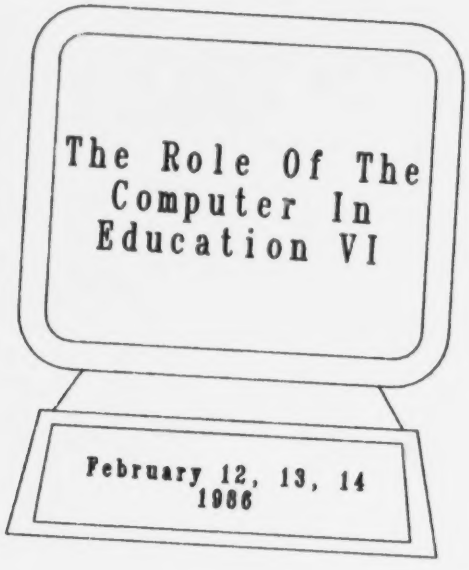

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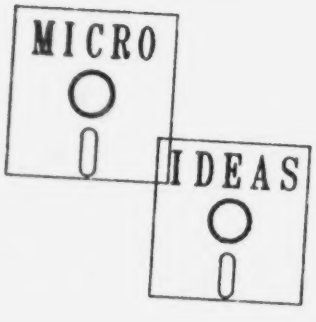

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Foreword

The Role of the Computer in Education VI

MICRO-IDEAS is proud to deliver the proceedings of the 1986 conference. A goal of this conference was to concentrate our view on the computer as a tool. The tool of interest for this year was the word processor. Word processing, as no other tool, is useful across age and subject, classroom and office. As the role changes for the computer, hopefully, so will our conference.

It has been said, "If the computer can do something better than a teacher, it should." Wise use of the technology can maximize the potential of the teacher as a means to improve education. This conference hoped to model effective and appropriate uses of the computer as an extension of the teacher based instructional system. Continued improvement in hardware and software will enhance the possibilities for integration and educational improvement.

The sixth conference brought new products, new vendors, and new ideas. Thank you all for coming, and mark your calendars for The Role of the Computer in Education VII on February 18-20, 1987.

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AN OVERVIEW OF THREE COMPUTER READING PROGRAMS

By: Ann Albin & Jo Ellen Monahan, Arcola School District #306, Arcola, IL

With new reading funds available this year, many school districts are considering the purchase of an integrated computer reading program. The Arcola, Illinois School District evaluated three major reading programs (all under $1000) in the 1985 fall semester. The programs evaluated were: **BRICK BY BRICK** (Hartley Courseware, Inc.), **MICRO-READ** (American Educational Computer), and **STEPS TO COMPREHENSION** (Educational Publishing Concepts). These programs were used extensively with a wide range of students, in a remedial reading classroom, and in normal elementary classrooms and computer labs. A summary of each program is presented below:

BRICK BY BRICK - This is a comprehensive early reading program for first through third level readers. Each level is made up of three components: vocabulary, usage skills, and comprehension. Each one of these components is divided into five steps. All fifteen programs in Level 1 have complete recordkeeping. Each level contains fifteen disks with back-ups, supplementary worksheets, phrase cards, placement tests, student progress charts, and teacher's guides. At present, two levels have been released, with Level 3 to be available this spring. Levels 1 and 2 cover regular 1st grade reading and 2nd through 4th grade remedial use. Each level costs $497 and requires the additional purchase ($49.00) of a CCD (cassette control device).

Comments: Four of the five steps of Level 1 require sound. This is provided by the teacher making 60 short tapes (< 10 minutes). The student picks his level on the disk, starts his tape, and the CCD regulates the tape recorder and the computer response together. The whole package prepared by Hartley was obviously put together by experienced first grade teachers. No teacher could ask for a more thorough program. It is time consuming and tedious to make the tapes, but once finished, they are done forever, and it does give a teacher a creative license to put her own example sentences on tape. The only other negative aspect is the number of computer frames (4) they use to introduce each new word or phrase. Some students became restless. But, to summarize, **BRICK BY BRICK** is a very thorough beginning reading program, with an internal, easily managed record keeping system.

MICRO-READ - This is an integrated reading program covering levels one through eight that fits with the basal readers used by the school. The first three levels must use the Super-talker sound synthesizer that comes with the program. There are 72 disk sides covering phonics, word analysis, vocabulary skills, comprehension and study skills. Each level may be purchased separately. There is no internal record keeping system, rather the student's progress is charted on student management folders which are included with **MICRO-READ**. The cost of all eight reading levels, with a sound synthesizer is $995.

Comments: This, too, is a very thorough reading program. However, it does not contain all of the support materials of **BRICK BY BRICK**. The voice quality is very good, and ear phones can be attached to the Super-talker. One disadvantage is that phonics pictures are repetitious, and some students tend to cue onto the picture rather than listen for the sounds. Also, the graphics and synthesized sound make the program slow to load as each new screen is introduced. The program includes a skills index chart, listing all the skills

by level and disk number, allowing the teacher to easily find the lesson she wants. If a school plans to use this on multiple computers, a Super-talker must be added to each computer running the first three levels.

STEPS TO COMPREHENSION - This computer-based reading program contains 8 disks, including a management disk, and covers reading levels 1-8. Its main objective is reading comprehension. Each program comes with a manual that contains reprints of the 90 original stories. The management system allows for record keeping of up to 60 students. **STEPS TO COMPREHENSION** requires actual reading rather than work on isolated skills. It is excellent for literal and interpretive comprehension practice. The cost is $245. There are two other programs available with the same format: **PRIMARY STEPS TO COMPREHENSION** and **HIGH STEPS TO COMPREHENSION**. PRIMARY STEPS has 36 stories, covers grades 1-3, and costs $159.50. HIGH STEPS has 48 stories, covers grades 4-9, and costs $199.50, and will be released 2/14/86.

Comments: The immediate feedback of a wrong answer is excellent. The program takes the student back to the passage where the answer is found, and highlights the correct sentence. The main criticism is the lack of inferential questions on the reading material, only literal comprehension and vocabulary are covered.

To summarize: All three of these reading programs could supplement any basal reading series and are especially appropriate for Chapter 1 or LD teachers. The major focus of **BRICK BY BRICK** and **MICRO-READ** is to teach. **STEPS TO COMPREHENSION** offers practice in comprehension skills with an immediate remedial feedback for an incorrect response. All three programs offer a teacher a chance to individualize the classroom by focusing on specific skills with the help of the Apple computer.

SIGNING UP: THE MACINTOSH WRITING LAB

By: Jay Amberg, Highland Park High School, Highland Park, IL

> "Word processing makes it easier for me to stay organized. It's really the same thing as writing, without the mess."
> Nicole Falk - Highland Park High School

In October, 1985, Highland Park High School opened a Writing/Word Processing lab. Eleven Macintosh 512 computers were set up in an English classroom formerly occupied by the school's English as a Second Language classes. In the succeeding four months, all HPHS freshmen and numerous other students learned to use the computers to organize, compose, edit, and proofread their papers.

BACKGROUND

In the spring of 1985, the District #113 Board of Education allocated funds for Deerfield High School and Highland Park High School to implement English writing labs featuring Macintosh 512 computers and ImageWriter printers. The Highland Park lab was also to include facilities in which students could receive individualized instruction and make up missed assignments. The problem facing the Highland Park English Department was that few teachers had ever seen a Macintosh much less used one. During an eight hour summer in-service workshop, ten teachers, most of whom taught freshman English, overcame their "Macfear" and became friendly with the computers. These same teachers identified three basic goals for the writing lab:

1. To make the lab operational early in the 1985-86 school year.
2. To instruct all freshman students in the use of the MacWrite word processing program.
3. To involve all teachers of freshman English in the use of Macintosh computers and the MacWrite program.

The teachers felt that the third goal was crucial to the success of the second goal. Unless the teachers of freshmen, many of whom had never used any sort of computer before, became excited about the use of the Macintosh to word process papers, the students would not likely become enthusiastic. To this end, the teachers in the summer workshop decided that each teacher should instruct his own classes to use the Macintosh. Three of the teachers volunteered to create instructional scripts and student worksheets for a five-period MacWrite unit.

THE WRITING LAB

The three initial goals were accomplished by February, 1986. The lab opened in early October, after the room had been repainted and rewired, tables and chairs scavenged, and a patient and diligent full-time teacher-aide assigned. Eventually, such amenities as a file cabinet, pencil sharpener, encyclopedias, and plants were added. The lab was staffed by the coordinator (the teacher-aide assigned eight of nine periods each day), English teachers (five of nine periods each day) and Educational Assistants (students whose knowledge of the Mac far surpassed that of any of the teachers). In the lab, students received help on English papers, took make-up quizzes and tests, learned to word process, and wrote and edited compositions on the computers.

Each HPHS freshman was taught the MacWrite word processing unit by his teacher. During the first instructional period, forty-two minutes in length, the students were introduced to the Macintosh. They moused around, learned the menu bar, opened windows and files, clicked and double clicked, dragged and scrolled.

During the second period, students learned to write with the Mac. They keyboarded, corrected errors by backspacing, mastered the insertion point, highlighted, and saved files. By the third period, students were already editing their writing. They moved words and sentences, cut and pasted with the clipboard, and found and changed words. During the fourth period, students learned to print their writing. They changed print instructions, fonts, and styles. Finally, they filled the trash can and emptied the trash.

The fifth day of the MacWrite unit consisted of a two-part competency test. During the first part of the exam, students keyboarded a paragraph, corrected errors, and saved and printed the paragraph. They then made substantial changes in the paragraph to make it more clear and concise, saved the new version, and printed it. The second part of the competency test consisted of multiple-choice questions about the Macintosh and the terminology necessary to use the computer effectively.

EVALUATION

The use of the writing lab exceeded expectations. The first week after winter vacation, for instance, when no classes were scheduled into the lab, 393 students used the lab either to word process their papers or to seek individual English instruction from the coordinator and teachers. In addition to the freshmen, junior and senior Composition Skills students completed the five-period MacWrite unit. The Composition Skills teacher said of the experience, "It was an incredible success--probably the best thing that happened to some of the students this year."

The follow-up work by the freshmen students has been excellent. One teacher, for example, reported that 90% of his students subsequently used the lab to write compositions. He also noticed a tangible improvement in the quality of papers. Another teacher commented, "The lab is the most exciting and beneficial innovation that I've seen in my time at the school. Within the course of a few months, we've gone from a few apprehensive teachers instructing their classes to a point in which the lab is literally overrun with students." A student interviewed at random said, "The computers definitely helped me. Instead of writing my paper over five million times, I can just make the changes in the lab, and I'm all set."

The teachers of freshmen adapted well to the new technology. Many of them regularly created assignment sheets, quizzes, and tests with the Macs. The teachers also extended themselves to work with students before school and during free periods. One teacher who had been reluctant to get involved at the beginning of the program became so enthused about the Mac that she purchased one for her home.

The prognosis for the writing lab is excellent. Teachers and students have retained a high level of enthusiasm. The MacWrite instruction second semester has been expanded to include all Composition Skills students, some sophomore classes, and two Creative Writing classes. Plans for the future include the expansion of the lab into a second room and the implementation of

sophisticated editing and proofreading software.

Tracy Kidder, in The Soul of the New Machine, a book about the creating and building of computers, uses the phrase "signing up" to describe the incredible commitment that engineers make when they offer to work on a new computer. Signing up, making the intellectual and emotional commitment to create a successful writing lab, describes well exactly what the Highland Park teachers and students did in the writing lab this year.

MICRO BASED LIBRARY RESOURCE SHARING

By: Eric S. Anderson, Micro Libraries, Des Moines, IA

THE NATIONAL/STATE/REGIONAL PERSPECTIVE OR WHY SMALL LIBRARIES CAN'T PLAY BALL

Small libraries, be it school or public or special, have had and will continue to have a tremendous uphill battle in the automation of library service. The only tool they possess is the microcomputer, and unfortunately the library automation community is still controlled by main frame mentalities. This control will continue, and the only alternative small libraries have to challenge a structure that doesn't care about them is to pull an end run.

The almighty dollar is the problem. Online bibliographic utilities were born in an age of expensive processing, expensive storage, and expensive use charges. Their structure is so "people heavy" and the chips and percs are so built into their bibliographic clubs and cliques that their principle concern is the preservation of their own outmoded and antediluvian systems. They protect their turf and will continue to protect their turf.

Protection of the "old guard" is done primarily through restrictive bylaws and outrageous use fees. They liberate records from what in all other areas is considered the public domain, copyright them and then charge you nearly two dollars to add your holdings symbol. Their technique is self preserving--once you have added your holdings to an online bibliographic vendor the cost of converting them to another system is enough to keep you in the fold. If you wanted to strip your records off the system and give them to another library as a gesture in kind, most of the online bibliographic utilities would not let you--regardless of the changes you had made in the record or the amount of original cataloging you had contributed to the system. There is little hope that fees will be reduced to the point where small libraries can participate, at least in my lifetime, and there is such a lack of concern for the "whole" of the library community that it contravenes your entire professional training.

Agencies and systems have evolved for the public good, and for the most part the public library, to bridge the gap between the bibliographic haves and have nots. These agencies, primarily funded through state and federal pass through funds have done, in most cases, what they could to include small libraries in resource sharing plans. Unfortunately there are not enough funds, or should I say the priorities exclude the funds being provided for extensive automation projects. The work flow of these agencies is usually so labor intensive, shuffling paper requests to a computer terminal to identify a "known location" or taking the paper based request to a paper file and performing a manual search and then instituting some sort of request process that it defies common sense. "Why a chicken? Why not a duck?"

It is logical, at least to me, that agencies extend their efforts into providing known location devices and then defining telecommunications protocols for folks to directly locate items and handle the requests themselves. I will go to the grave believing that the burden, including and principally the cost of an interlibrary loan, should be borne by the library that issues the request.

There is no quick and dirty solution to this problem for two reasons. The principle problem is the lack of standardized electronic bibliographic records

for the small libraries. They have been unable to afford them and so do not have them. If indeed the records were available, current library turf concerns would stifle their use and application. The only shining light in this scenario is the outstanding work done in Wisconsin with the Mitinet/Wiscat program. The records are still in fiche and folks are still screaming about ownership of the records and although that candle may be flickering in the wind, it still is lit and they are adding 1.2 million records per year to their data base. A good deal of those records come from schools and small public libraries.

Their fees, their rules, and their total ignorance of our needs keeps small libraries out of their ballgame. As long as we identify where we stand we can take a course of action to provide the folks who use our libraries the stuff they need.

WHERE DO SMALLER LIBRARIES FIT IN?

The perspective most folks lose in their glorious plans for resource sharing is the perspective of the person who is requesting the material. They may come in with a citation from some obscure journal, but what they really want is some type or kind of information to meet their needs. They don't care if it comes from the public library down the street or the Zambesie Public Library. They have an information need and the mission statement of almost every library in this land is providing them with that information. The problem the library profession has created is some bizarre concept of "all information on every subject for all folks in all formats". I would contend that the library profession needs a little reality therapy. I would rephrase it as "giving the folks that use my place the information they need short of the price of the first born child."

What is micro based library resource sharing? It is a local attempt to meet your needs. Ostensibly it is between your library and another; at most the group will stay small enough so that you can avoid bylaws and regulations. The bigger you are the harder you fall. Everybody pulls their own weight and foots their own bill. Sharing is a tremendous concept until it cuts into materials budgets.

AND NOW, FOR THE HOW TO

Every school library in your county (or for you suburban Chicago folks, every library in your district) decides to share periodical holdings. In a traditional world, this would be a labor intensive, paper based task. With the micro, it becomes a simple reality. You may care to add the holdings information for the public library (libraries) and the local hospital library. Within twenty miles or twenty minutes you have a micro based locator.

What is the easiest way to accomplish this task with a micro? If each library uses the same data base management package you create a common template and have everyone key their holdings in. Bring all of the data disks together and merge the file. Make sure you include a field for location so the file may be sorted - and whatever listings you make will display - where the stuff is. Something as simple as APPLEWORKS will do the trick nicely.

Before you go hog wild (a favorite Iowa saying) and dream up a score of similar projects to accomplish, I must present one warning: micro means small. The hardware will not produce a list of all union members who have ever belonged to any union in any place at any time. You have limits on the

amount of storage you have available. As with the tortoise and the hare: start slow and make steady progress.

If the file is going to be larger than any of the single machines can handle you have two strategies to invoke. The first involves splitting the file; an alphabetical range from A-M for example. The second requires appointing one of the members Hardware Wizard and souping up a machine at one site. Hackers always rise to the top, and more than likely the impetus for the project will come from someone with expertise.

For the principal of argument, let us assume that ten libraries will share their periodical holdings. Each library has 100 titles, so the file will have 1000 merged records. If each of these records averages 150 characters per record, your plain old vanilla Apple IIe with 128K and APPLEWORKS just won't cut it. Knee jerk reaction is to split the file so that titles A-M are in one and N-Z are in another if you only want a titles list that will work. If you want a holdings list, you are spending a lot of time on the clipboard. Take one of the Apples to 512K of RAM, or even a meg if you're adventurous, and merge all of the files on that machine. Since that site has been good enough to take care of the good stuff, another should volunteer to make the copies for the cooperative.

With a basic idea in place, the limits to local micro based library resource sharing are in essence left up to the creativity of participants. As easily you could create a union list of videotapes, micro software, AV equipment, or library processing supplies. It is not my place to tell you what to do, but rather to offer the concept and let you develop it to meet your needs. And that is something you will rarely get from a national utility.

COMPUTER APPLICATIONS IN GRAPHIC ARTS

BY: David Barber, Danville High School, Danville, IL

INTRODUCTION

The microcomputer is an important tool to the technology teacher. It has allowed us to have equipment that has not been affordable before. The microcomputer has given us the ability to simulate and many times duplicate functions of more expensive industrial equipment.

Technology teachers have available the microcomputer to teach students: Computer Aided Design, Computer Aided Machining, typesetting, inventory control, robotics, management skills and other industrial applications.

Because it is very important to teach our students the types of jobs they will face once they leave school, we must begin addressing their need to know how computers are being used in industry. We need to have in our high schools, courses that teach practical applications of computers in industry. But, everyone cannot see the importance of teaching students about industrial applications of computers. That is why, as technology teachers, we must make aware to other teachers, administrators, and the public, the need to have computers in our shops.

My present concern is the use of computers in the education of graphic art students. The justification for teaching graphic art students computers is evident when you look at printing industry trends. Industrial analysts predict the future in printing is in electronic publishing. Many of the present and future jobs in printing will involve the microcomputer. Industry is using computers to: digitize graphics, for typesetting, ad layouts, page layouts, for monitoring job progress and estimations of job costs.

I have been using an Apple IIc in my classes to provide students experience in typesetting, digitizing, page layouts, copyfitting and estimating costs of a job.

The hardest part of getting started with microcomputers is obtaining a computer and finding software that would serve the needs of the graphic art students. After receiving my computer, I began looking for software that could be used for typesetting. True industrial typesetting machines are very expensive and, therefore, one of the machines that most high school print shops do not have. Although the microcomputer with a dot matrix printer cannot produce typeset quality printing, it can give students the experience of typesetting. Because layout and design is one of the hardest things for graphic arts students to do, I wanted software that would help them be creative and produce quality layouts.

I tried several programs and found that a good word processor along with PRINT SHOP software worked well. The word processor is used to set the body text and PRINT SHOP is used to set headlines, create banners, create borders and provide a large selection of clip art. Through cut and paste techniques, the students combine all materials created on the computer into a camera ready layout. I later added programs that gave a larger selection of fonts and capabilities of digitizing graphics, such as DAZZLEDRAW, MOUSEPAINT, KOALAPAINTER AND FONTRIX. DAZZLEDRAW, MOUSEPAINT and KOALAPAINTER allow students to easily draw their own graphics using either the Mouse or a Koala

pad. FONTRIX is by far the best software for setting type and creating borders. It has the largest selection of fonts, can be used to create graphics, can merge other DOS 3.3 based graphics into its layout, and, best of all, it can create a complete page layout. I have also added NEWSROOM to my selection of software because of its page layout capabilities and large selection of graphics. NEWSROOM has very good documentation that can teach students about the creation of a newspaper.

A video scanner that can input images into the computer is an excellent addition for giving students the knowledge of how scanners work. A good choice for the Apple IIc is COMPUTER EYES by Digital Vision. COMPUTER EYES allows you to scan images into PRINT SHOP, NEWSROOM, and any Double Hi-Res drawing program.

I believe it is important to teach students skills in the management of a print shop. There are several programs available for giving students experience in estimating costs and billing of a job using the computer, such as PRINT CALC and WHAT IF. I am using a costing and billing program that was created by a high school teacher, and published in SCHOOL SHOP magazine.

For general instructional software, I have found the GRAPHIC COMMUNICATION SERIES by Hobar provides a complete package for skill development in about every area of graphic arts. The software, CAMERA SIMULATOR, by Brain Builders is a good program for teaching students the fundamentals of photography and proper camera use.

The microcomputer as a front end for a typesetter is a trend the printing industry seems to be following. For those print shops that have older typesetting machines, there is an interface that will allow you to connect a microcomputer to them. MICROSETTER by Teletypesetting Co. is one such interface.

My future plans are to add an Apple Macintosh computer and LaserWriter printer to my shop. In my opinion, the Macintosh computer is the leader in desktop publishing. There are many programs written for the Macintosh that allow it to set type, layout complete pages and merge graphics with type on the pages. There is a large selection of graphic and font software for the Macintosh that allow students to be creative.

The Macintosh computer with the LaserWriter printer is an excellent combination for handling many typesetting needs of the printing industry. The affordable price and near typeset quality of the Mac-LaserWriter makes it a good choice for use in the education of graphic art students. Students can learn to set type, layout pages and digitize images using the Mac and LaserWriter.

I believe the microcomputer is an important part of graphic arts education. The ability of the computer to motivate is evident to any one who has used them with students. I have students standing in line every minute of every day to use the computer to create their layouts for printing. The computer gives the students the feeling of accomplishing something of worth and motivates them on to other skills in the print shop.

LIST OF SOFTWARE AND HARDWARE COMPANIES FOR THE APPLE IIe OR IIc

APPLEWORKS & MOUSEPAINT
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014

CAMERA SIMULATOR
Brain Builders, Inc.
Dept. A+
P.O. Box 11324
Hauppauge, NY 11788

COMPUTER EYES
Digital Vision, Inc.
14 Oak Street/Suite 2
Needham, MA 02192

ENHANCEWORKS
Dat Software
P.O. Box 33873
Granada Hills, CA 91344

FONTRIX
Data Transforms
616 Washington St.
Denver, CO 80203

GRAPHIC EXPANDER & NEWSROOM
Springboard Software
7807 Creekridge Circle
Minneapolis, MN 55435

HOBAR EDUCATIONAL SOFTWARE
1234 Tiller Lane
St. Paul, MN

KOALAPAD
Koala Technologies
3100 Patrick Henry Drive
Santa Clara, CA 95052

MEGAWORKS & REPORTWORKS
MegaHaus Corp.
5703 Oberlin Drive
San Diego, CA 92121

MICRO-W FONTS
P.O. Box 113
Pompton Plains, NJ 07444

MINIPIX DISK #1
Beagle Bros.-Dept. A
3990 Oldtown Avenue/Ste. 102C
San Diego, CA 92110

PINPOINT
Pinpoint Publishing
Box 13323
Oakland, CA 94661

PRINT-CALC
Printers Software Publishing Co.
23011 Moulton Parkway/Unit F2
Laguna Hills, CA 92653

PRINT SHOP
PRINT SHOP COMPANION
PRINT SHOP LIBRARY DISKS
DAZZLEDRAW
BroderBund Software
17 Paul Drive
San Rafael, CA 94903

PRINTER'S DEVIL
Disk-of-The-Month-Club
Box 116
Fairlawn, NJ 07410

PS GRAPHIC MAKER
Big Red Apple Club
1105 S. 13th--#103
Norfolk, NE 68701

TYPESETTING INTERFACE
TeleTypesetting Co.
224 Nickels Arcade
Ann Arbor, MI 48104

WHAT IF
P.O. Box 7612
San Jose, CA 95150

TESSELLATIONS AND LOGO

By: Donna Bearden, MICROQUESTS, McKinney, TX

Exploring tessellations provides students and teachers an opportunity to combine research and design, mathematics and art, creativity and logical thinking. Logo becomes the powerful tool that makes many of the explorations possible.

A tessellation is a repeating pattern of shapes, with no shapes overlapping and no gaps between the shapes. Students may begin by playing with (exploring, if you must be serious) shape blocks. Through their experiments, they will discover the regular polygons that can be repeated to cover a plane: squares, triangles and hexagons. Questions evolve naturally. Why does a hexagon tessellate? Why can't you tessellate an octagon? What shapes can you combine to form more elaborate tessellations? They may not verbalize the questions, but they are working with them.

As students begin to create tessellations, they will begin to be more aware of repeating patterns around them. Many are designed by people and some are created by nature. A wonderful detour might be to explore soap bubbles and what happens to their roundness as more and more bubbles are confined between two layers of plexiglass.

Another fun experiment is to create a kaleidoscope that turns simple designs into repeating patterns. Tape three small rectangular mirrors together into an equilateral triangle. The reflecting surfaces should be facing the inside. Trace around the triangle to make a pattern the same size as the kaleidoscope. Cut out several triangles. On one of the triangles, find the midpoint of each side. Draw a line from that point to the center of the triangle. (If your lines are perpendicular to the sides, they will meet in the center of the triangle.) Shade each section a different color. Place the kaleidoscope down on the triangle and look at the resulting tessellation. (To look in the kaleidoscope, get down on the same level with it and peer over the side of one of the mirrors into the reflections of the two other mirrors.) The triangle is rotated into a hexagon and the hexagon is repeated in all directions as far as you can see.

Try other designs with the remaining triangles you cut out earlier. Try some elaborate and some simple. Which work best? Use the kaleidoscope to check out patterns around the room: someone's shirt, wallpaper patterns, pictures in books. Repeating patterns, or tessellations can be created out of almost anything.

Logo can be used to explore kaleidoscope-like designs on the computer. Up to now, you've been working mainly with design. Adding Logo to the experiments will bring in the mathematical angle (totally innocent pun) and the problem solving skills. First write a procedure to draw an equilateral triangle. Make the triangle 30 turtle-steps to a side so the final figure will fit on the screen.

illustration 1

```
TO TRIANGLE
...

END
```

Use your procedure in another procedure to create a hexagon.

illustration 2

```
TO HEXAGON
...

END
```

Put several hexagons together to make a tessellation.

illustration 3

```
TO TESSELLATION
...

END
```

(I could include my solution, but then you wouldn't have the fun of working it out for yourself.)

Now go back to your original triangle procedure and add some commands to cause the turtle to draw a simple design within the triangle. Be sure to return the turtle to its original position. For example, if you turn right, go forward, turn left and go forward to create the design, you must then go backward, turn right, go backward and turn left.

```
TO TRIANGLE
REPEAT 3 [FD 30 RT 120]
RT 30 FD 20 LT 90 FD 10
BK 10 RT 90 BK 20 LT 30
END
```

Once the triangle has been edited to include your design, call the TESSELLATION procedure and watch what happens!

Similar explorations can be done using squares.

illustration 4

After students have spent some time designing tessellations and comparing them, bring in some of Escher's work. What a master tessellator! If you will look carefully at some of his designs, there seem to be faint pencil marks showing regular polygons. One way he might have created his designs was by using point symmetry to alter the sides of the original shapes. We'll try a simple exploration to demonstrate how this might be possible.

Using an equilateral triangle, alter the sides as follows. Find the midpoint of one of the sides. That will be the point of symmetry. Curve half of the line out and the other half in.

illustration 5

Repeat the process for the other two sides.

illustration 6

The Logo procedures to draw the curved triangle might be defined as follows:

```
TO CURVED.TRI
REPEAT 3 [CURVE RT 120]
END

TO CURVE
REPEAT 16 [FD 3 RT 10]
REPEAT 16 [LT 10 FD 3]
END
```

(You're not stuck with this curve, it just happens to be the one we settled on.)

Just as it was possible to cover a plane with equilateral triangles, it is possible to cover the plane with curved triangles.

illustration 7

Now go back to Escher's drawings and study them. Some students might like to attempt to create more elaborate tessellations using point symmetry and Logo procedures. It's not easy, but it's incredible problem-solving activity and if you've built the steps through the off-computer activities and the easier computer tessellations, they've got the tools to work with.

BIBLIOGRAPHY

Bezuszka, Stanley; Kenney, Margaret and Linda Silvey. Tessellations: The Geometry of Patterns. Palo Alto: Creative Publications, Inc., 1977.

Martin, Kathleen and Donna Bearden. Mathematics and Logo. Reston: Reston Publishing Co., Inc., 1985.

Martin, Kathleen and Donna Bearden. "The World of Symmetry," MICROQUESTS Vol. 1, No. 2, Oct. 1984.

Martin, Kathleen and Donna Bearden. "Ratio and Proportion," MICROQUESTS Vol. 2, No. 1, June 1985.

Macgillavry, Caroline H. Fantasy and Symmetry: The Periodic Drawings of M.C. Escher. New York: Harry N. Abrams, Inc., 1965.

Thornburg, David. Discovery Apple Logo, An Invitation to the Art and Pattern of Nature. Reading, Mass: Addison-Wesley Publishing Co., 1983.

Wilson, John. Mosaic and Tessellated Patterns. NY: Dove Publications, 1983.

ILLUSTRATION #1

ILLUSTRATION #2

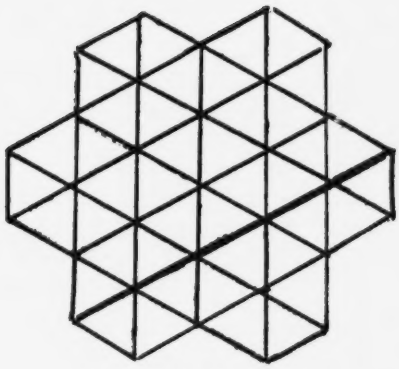
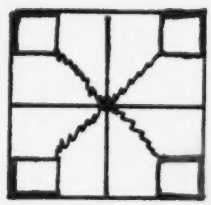


ILLUSTRATION #3



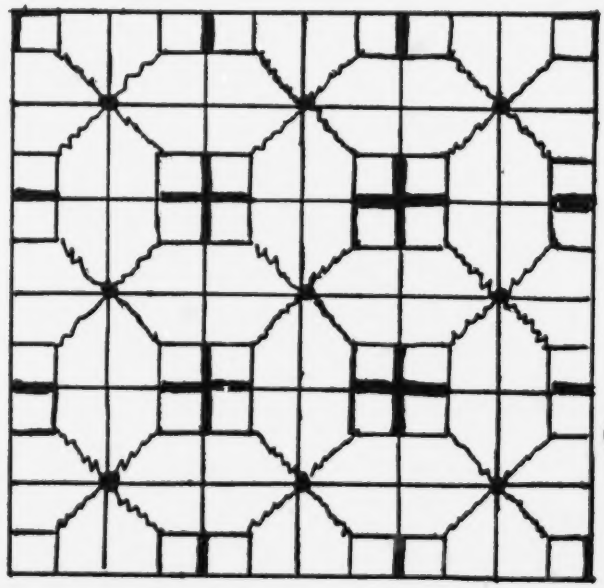


ILLUSTRATION #4

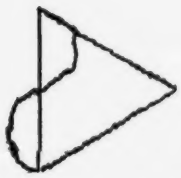


ILLUSTRATION #5

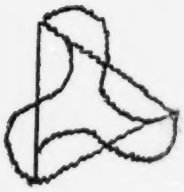


ILLUSTRATION #6

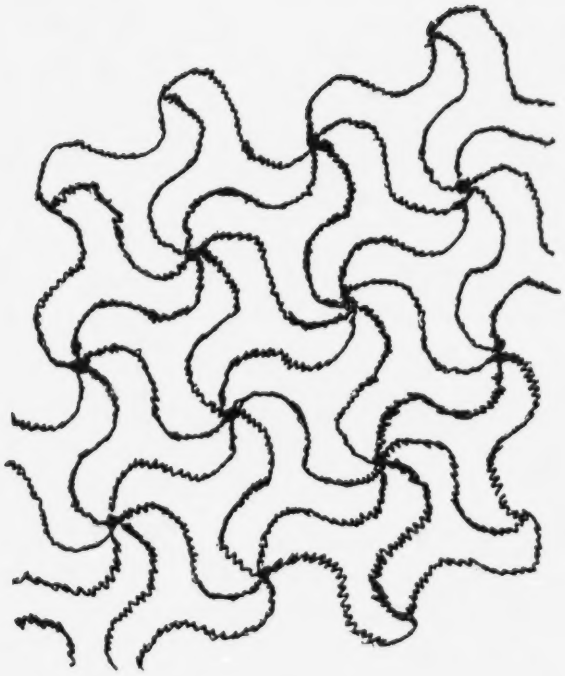


ILLUSTRATION #7

BEGINNING WITH COMPUTERS IN YOUR SCHOOLS

By: Mary Louise Berger, School District #67, Morton Grove, IL

There are three main ingredients when beginning with computers:

1. You must have a vision of where you want to go and what you want to accomplish;
2. You must have a plan; and,
3. You must have the energy and perseverance to succeed.

Because the computer field is moving ahead at such speeds of technological advancements, the beginner, no matter if referring to school or home use, can feel overwhelmed when approaching the subject. The machinery is new, the words surrounding computers can sound like an entirely new language, and it forces the user into a "student role" of asking questions, and investigation.

At District #67, the vision began in 1980 with the now retired Joe Sullivan, Principal of the Junior High. He ordered several TRS-80's that used tape recorders instead of disk drives. This was the beginning. Later, Apples were introduced into the district. The next step took place in 1983 when a committee was formulated to plan the short and long term strategy for computers in the district. The people chosen for the committee were those who had interest or experience in computers, or those staff members who need to be involved because of future plans, like the Media Directors of the individual schools.

These teachers, along with the administrators, joined hands and ideas along with our consultant, Kay Hicks, of MICRO-IDEAS. Areas addressed by the Committee were the following:

Yearly budget
Hardware needs
Software needs
Teacher inservice and classes for credit
Computer curriculum
Teaching staff
Housing and processing of the software
Computer/Software utilization policies
Copyright policy
Computer lab formation
Office staff utilization of computers
Security Systems
Area Service Centers

When your district begins to make the decisions for the future of computers in your schools, the most important thing that your newly formed committee can do is to brainstorm all the possible uses that could be created for computers in your school setting. Then, do the same brainstorming process for all the areas that would be necessary to include for the success of the computer program at your school. Don't forget to list the possible stumbling blocks too! Forewarned is forearmed. From this list, create the vision that your committee sees in the future for your school. Don't forget items like the philosophy, the goals of each area, parental participation, or networking systems between buildings. The next step is to break the dream down into

realistic blocks. At this stage, visiting schools with programs already in operation can add to your ideas. What can be done the first year? What support areas will be important to the purchase of hardware and software? Remember, unless your staff feels comfortable with computers and will use them, they are a wasted purchase.

YEARLY BUDGET

One of the most important areas that needs to be covered on a yearly basis is that of a budget. If given enough time, the Committee cannot only estimate what money will need to be requested (based on their plan for that year), but also the rational of how each item will be utilized. They can also plan on any additional money received through State funds or Grant money. While planning for funds, don't forget your local PTA or the Student Council as another source of potential income. When working with a budget, remember to include hardware, software, salaries for additional staff time, software storage costs, construction costs, consulting time, teacher inservice cost, supplies or area workshops. Perhaps your district already provides for some of these items in another section of their budget. In addition to a yearly budget, there should be a long term plan which will help to design a three year budget. This long term budget cannot extend much beyond three years because of the rapid changes in the computer hardware, software, and the prices of each.

HARDWARE NEEDS

Each member of the Committee will have their own version of the hardware needs of the District. This is one of the reasons that a district plan is so important. Some items to remember about hardware is that once you begin with one brand (Apple, TRS, IBM, Radio Shack, Acorn) you would be smart to stay with that choice. The reasons are simple. First of all, your software will all be compatible with every computer. The other major reason is that it makes computer repair and upkeep a much simpler operation. Also, be aware that some computer companies lean more towards school, business, or the home market. This will make a difference in the software available for educational purposes with some companies. So, investigate the hardware pros and cons before you begin, and not five years into your program.

When dealing with peripherals (which are the items that you can hook up to a computer like printers, joysticks, etc.) be aware that some items work better with some computers than with others.

For example, some printers have no problems with some computers and yet have difficulty running programs on other computers. How will you know which to buy? Begin reading the many articles available through the hundreds of computer magazines now on the market about the areas you question. Second, decide the purpose of the printer, student use, library administration and card processing, office work, and classroom printer. Finally, once you have decided on your computer brand, go to a store that only sells printers and discover the many options available and what will best meet your needs.

The two main differences in printers is that one type called "letter quality" can do an excellent job of producing type. It functions similarly to a typewriter with a metal piece that strikes and produces type. The other type of printer is called "dot matrix". Its letters are formed by many dots that sit very close together. The benefit of the dot matrix is that it can be used to create pictures called graphics in addition to creating letters which vary

in quality according to the particular printer. Currently, there is also another method developing to create type in a printer using lasers.

SOFTWARE NEEDS

Software is a computer program developed to instruct a computer to carry out specific tasks. There are five major types of computer software on the market: Drill and Practice, Tutorial, Games, Simulations and Utilities. It is very important that the committee decide how to organize the software, hardware and scheduling of each of those areas. Our district was very fortunate to have started out purchasing all computer software through the Media Centers of each building for use in those buildings. It was treated like any other piece of audio visual software in regards to processing, storage, cataloging and check out ability. This eliminated duplication of purchases, set up a standardized method of storage and eliminated the problem of lost written material. It also created a one spot location of all backup diskettes.

When planning to buy software for your school, you need to be concerned about the quality of the software and the needs of your teachers and staff. Software evaluation is one of the most important areas because the software available for purchase does not always meet good educational standards. There are several things that can be done to insure thoughtful purchases. Every teacher who previews a program needs to fill out a simple evaluation form designed by the district. In addition, if the program meets the standards of the teacher, the librarian should preview the same material with a much more detailed evaluation form. If the material is not found to be of a high caliber, then the librarian should recommend other possible software. One good source for additional software is Software Review. This publication rates software. There are also many other directories and reviews out that discuss the software merit.

Publishers are beginning to specialize in particular types of software: gifted, special education, math, science, etc. When purchasing software, be aware of the importance of previewing, and check out the policy of the individual publishers. There are also not many companies that have catalog cards for software purchases, but Follett and MECC are two that are available.

TEACHER INSERVICE AND CLASSES FOR CREDIT

If a district has made a commitment to computers for their schools, then the only way to assure the educational use of the computer with the students is to computer educate the teachers of that district. At every stage of the district computer plan, teacher inservice should be considered. The first year, begin at the beginning and introduce all of the teachers to the computer as a tool to use in their classroom. Demonstrate the variety of ways that this new tool can be an addition: gradebook management, programs to supplement their classroom teaching, methods to help remediate slower students, projects for advanced gifted students, methods to develop study guides, or ways to create reports to go home to parents about student progress. From there, software evaluation can be discussed, and then onto previewing programs that apply to their areas. In addition, classes could also be offered to any staff member (teacher, aide, secretary, administrator, etc.) in any number of areas of interest. The reason that these classes should be open to all of the staff is because the more people that feel comfortable with computers, the more likelihood of success in your district with computers. An extra incentive could always be to have the class give

optional graduate credit. One way to determine the needs of the staff is to put out a survey that questions the interests of the staff. As time goes on, the variety of interest will increase, and at that time, you may consider more outside workshops to meet that time you may consider more outside workshops to meet individual needs of the faculty. Don't forget to develop a program for new staff members to acquaint them with programs, hardware, policies and the general computer plan of your school.

COMPUTER CURRICULUM

The best qualified person to design a computer curriculum would be the person who will be teaching the computer programs. It would be advantageous of the Committee to refer to the long term plan for any ideas that would need to be incorporated into a curriculum. The other important factor is to do some articulation with the high schools in the area to determine course continuity. This also is an important step for people in like areas to begin a network of support for each other. An example of this would be: setting up an elementary school inservice workshop and holding it at a computer lab at the high school. The other important aspect of a computer curriculum is that it cannot be engraved in stone. With the constant advancements in this area, this curriculum must be flexible to meet the needs of the students, staff, and the times.

TEACHING STAFF

Currently, the educational requirements are not very demanding for computer instructors. It would be wise to encourage any teacher of computers to either begin taking courses in computers, or for those teachers who have some background, to keep up with the new technology, especially in the areas in which they are teaching. There are many colleges and universities who are granting degrees in computer science, and several more who are gearing the degree to educational computer science. Another area is that of increased personnel because of the increased usage of computers. Some schools may find that the extra staff person is needed in the processing of materials and maintenance of the supervision of the Media Center computers. Another area is that the time that the computer teacher needs to spend in the classroom is increased. The third possible expansion is that of a person who will supervise the computer lab for classroom teachers who wish to have their entire class use a particular program. So many schools who have not had a person to help with the computer lab have found that the classroom teachers do not feel like they have adequate skills to deal with any machine technical problems, locate the programs or operate the lab and also teach the class and maintain discipline. Those labs soon were not utilized as often as possible.

HOUSING AND PROCESSING OF THE SOFTWARE

There are several problems with software. FIrst, it needs to be determined if theft is a problem and is a factor to be considered when talking about housing the software. Next, many containers for software are bulky or not sturdy for school use and will have to be replaced with another system of storage. Another area is that of cataloging computer software. The system currently in use is being looked at by the Committee who reviews AACR2. The best information on cataloging for media specialists who need to catalog computer software is being offered by Northern Illinois University through their extension courses.

COMPUTER/SOFTWARE UTILIZATION

One of the main goals should be to maximize the utilization of the purchases

made towards the computer program. There are many ways to go about doing this and the following ideas only represent a sampling. A computer lab can be set up with enough computers for an entire class with no more than three on a computer depending on the project. Another method is to have several computers placed on carts with wheels. At District 67 we call these "floaters". They will be wheeled into classrooms at a teacher's request for classroom use either for individual work, or to be hooked up to a large television for viewing by the entire class. Another method of utilization would be a "mini-lab" located in the Media Center where students would have access to programs and computers before school, during their recess time and for any individual time for work on the computer assigned by a classroom teacher for remediation or advanced work. This mini-lab can also be utilized by the classes who are involved in the Media Center program during the week. A computer club is another option for those students who would like to gain even a broader knowledge of computers and their functions. A computer and printer could be placed in the teacher's workroom for easy access and privacy while doing a grading program or any other utility program. In addition, the teachers can be given an option to take a computer and software home over any vacation. After school or evenings would provide an excellent time for parents of the district to be introduced to computers with a beginning course. It also helps build a supportive community group.

A policy on the distribution of blank diskettes for teachers' use is another area for discussion. The Committee for our District decided that on request, any teacher would be given a blank diskette and would be asked to explain how it would be used. This form would then be used to help determine quantity control and reordering for the next year. There was not any limit to the number of disks which could be requested.

COPYRIGHT POLICY

Public Law 96-517, Section 7(b) of the United States Code, allows for the making of a backup copy of computer programs for archival purposes. That is a sure statement. The remainder of the copyright laws have had varied interpretations, and there has continued to be controversy regarding the copyrighting of computer software. The International Council for Computers in Education has published policy statements on networking and suggested district policy statements on software copyrighting. These would be excellent to consider before your Computer Committee. Another area to be aware of is that each publisher of software can place a licensing agreement or warranty on their software with stipulations. BE SURE YOU READ THE FINE PRINT WHEN YOU RECEIVE ANY NEW SOFTWARE.

COMPUTER LAB FORMATION

When developing a computer lab, you must take into account how much space you are working with, how much cash you can afford to spend and for what purpose you are creating the lab. Some suggestions would be that if you are going to build a lab: (1) Order all of your hardware at the same time. (2) Don't be cheap and not get enough computers and printers to accommodate an entire class remember, if you think ahead, you'll save steps. (3) Figure in the cost of furniture whether it is built-in or ready made. (4) Hire an electrician who understands about dedicated lines, a MOV, blackouts, static electricity and uninterrupted power sources. If they don't know what you're talking about DON'T HIRE THEM. (5) Be aware of computer table heights and chairs that are straight backed. (6) Design the lab so that the teacher can easily get to all of the computers (the best placement is around three walls of a room). (7)

Design a method to anchor the cords and cables for the safety of the students and the computers. (8) Consider networking the computers with either a hard Corvus system, or the Wolsten floppy disc system. (9) Protect the lab from the elements: direct sunlight, extreme heat, and smoke. (10) Send someone to a computer basic maintenance course to take care of the minor repairs and cleaning. (11) Get at least three bids for any work done, hardware or furniture purchased and set up specific statements about height, work to be accomplished, date to be completed, and put it all in writing.

OFFICE STAFF UTILIZATION OF COMPUTERS

Schools are like businesses in many ways, especially when it comes to working in the front office. A computer has so many uses for the secretary. When thinking about office computers, begin thinking in a business sense for networking schools together and software to meet business needs, not education. Remember to include the inservice needs for the secretarial staff and administrators.

SECURITY SYSTEMS

With the formation of monitored security systems, it seems that computers would be much safer than they would be otherwise, and that is true. Unfortunately, installing a movement sensor alarm does not seem to be enough. Schools are encouraged to: (1) Label all computers with an engraving tool on the inside and the outside of all pieces of the computer equipment. (2) To purchase additional security devices at the same time that the computers are purchased. (3) To deal with service facilities which provide verification of computer ownership when serviced.

MICROCOMPUTER ASSISTED MATHEMATICS
SOFTWARE, APPLICATIONS AND PROGRAMMING

By: Gary G. Bitter, Arizona State University, Tempe, AZ

RESEARCH

Kulik Meta Analysis, ASU research, NAEP, John Hopkins-1985, Logo, Arithmetic Teacher-October, 1984 and Others.

MATHEMATICS CURRICULUM

Recommendations

Basic math skills	NCSM
Agenda for action	NCTM
The mathematical sciences curriculum K-12	
"What is still fundamental and what is not."	CBMS
Impact of computer technology on school mathematics	NCTM

Considerations

- Skills for future
- Calculator
- Computer

Changing the Curriculum

- Government
- Test bureaus
- Publishers
- School boards
- Math teachers ??

Technology Considerations

- Teaching method
- Content
- Sequence
- Topics

INTEGRATING THE MICROCOMPUTER INTO THE CURRICULUM

1. Committee
2. Outline the issues-goals
3. Decide which objectives the microcomputer can support
4. Systematically develop each objective
5. Develop microcomputer infusion ideas by subject matter
6. Develop integrated scope and sequence curriculum
7. Determine a microcomputer activity for each objective
8. Determine level of infusion
9. Examine software which can be integrated into the subject matter area
10. Establish long term infusion procedure
11. Hardware
12. Training
13. Implementation

14. Equity
15. Ethics
16. Resource teacher(s)
17. Evaluation
18. Community involvement
19. Revision
20. Constant modernization and planning

K-8 MATHEMATICS

TOPICS
Operations
Rules
Scientific notation
Rounding
Errors
Estimation
Algorithms
Models
Random
Arrays
Decimals to fractions
Fractions to decimals
Repeating decimals
Number theory
Divisibility
Surveying measurements
Averages
Unit conversions
Telling time
Trigonometry functions

PROBLEM SOLVING

TOPICS
Define the problem
Analyze the problem
Plan a problem solution
Writing the pseudo code or flow chart
Write the code
RUN THE PROGRAM-EXPLORE
Documentation

Show the different ways you could spend your $15 in Tina's Toy Store. Buy no more than two of the same kind (Grade 3, McGraw-Hill, 1981).

Two possible answers:
File: Grade 3.toys Page 1

TOY	HOW MANY	PRICE	TOTAL
Frisbee	1	$1.00	$1.00
Kite	1	$3.00	$3.00
Baseball	1	$2.00	$2.00
Baseball Bat	1	$5.00	$5.00
Model Plane	1	$4.00	$4.00

TOTAL BILL: $15.00

File: Grade3.toys2 Page 1

TOY	HOW MANY	PRICE	TOTAL
Frisbee	2	$1.00	$2.00
Kite	0	$3.00	$0.00
Baseball	2	$2.00	$4.00
Baseball Bat	1	$5.00	$5.00
Model Plane	1	$4.00	$4.00

TOTAL BILL: $15.00

This table shows the price of automobile parts at two different auto supply stores.

NAME	TIRE	BATTERY	MUFFLER	WINDSHIELD WIPERS	HEADLIGHT	HUB CAP
Store a	$29.90	$38.00	$29.75	$7.50	$3.65	$10.25
Store b	$31.75	$35.69	$23.95	$6.95	$4.50	$ 9.00

Bruce wants to buy a headlight, hub cap, and battery. He wants to buy everything at one store. At which store would it cost him less money? How much less? (MacMillan, Grade 7, 1977)

File: autol
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		PRICE	NUMBER		SUBTOTAL
STORE A	tire	$29.90	1		$ 0.00
	battery	$38.00			$38.00
	muffler	$29.75			$ 0.00
	wipers	$ 7.50			$ 0.00
	headlight	$ 3.65	1		$ 3.65
	hub cap	$10.25	1		$10.25
				BILL	$51.90
STORE B	tire	$31.75			$ 0.00
	battery	$35.69	1		$35.69
	muffler	$23.95			$ 0.00
	wipers	$ 6.95			$ 0.00
	headlight	$ 4.50	1		$ 4.50
	hub cap	$ 9.00	1		$ 9.00
				BILL	$49.19
				DIFFERENCE	$2.71

A family has a yearly income of $15,350. Using the information in the following table, find how much is spent in each category. (Grade 8, McGraw Hill, 1981)

CATEGORY	PERCENTAGE
Taxes	23%
Food	16%
Housing	32%
Transportation	15%
Medical	4%
Other	10%

File: personal.income
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Total Income $15,350.00

CATEGORY	PERCENTAGE	AMOUNT
Taxes	23%	$3,530.50
Food	16%	$2,456.00
Housing	32%	$4,912.00
Transportation	15%	$2,302.50
Medical	4%	$ 614.00
Other	10%	$1,535.00

NUMERATION

GRADE OBJECTIVE	SOFTWARE
GradeK Given two sets of blocks learner will match them one to one	Stickybear Numbers Weekly Reader *Family Software
Grade 1 Numerals 0-9, learner will form each numeral correctly	Koala Pad Touch Tablet *Koala Technologies Corp. Number Recognition 5-10 Aquarius Publishers
Grade 2 Two-digit numerals, learner will identify how many tens and ones are represented	The Game Show (teacher *Advanced Ideas, Inc.

Grade 3 Numerals 0-999, learner will identify the numeral in a given place	Expanded Notation Hartley Courseware, Inc. Create-Lessons (teacher modifiable) Hartley Courseware, Inc.
Grade 4 Numerals through hundred thousands, learner will identify the numeral in a given place	Grand Prix Place Value Random House School Division
Grade 5 Numerals through hundred-millions learner will read or write the numeral	Koala Pad *Koala Technologies Corp.
Grade 6 Whole Numbers 0-50, learner will identify the prime number	Math 1-2-3 Four Pack Prime Numbers and Factors (C-64) Tug o' War *MicroEd, Inc. Bumble Plot The Learning Company
Grade 7/8 Whole numbers to 9 digit learner will be able to identify place value	The Game Show (teacher modifiable) Advanced Ideas, Inc. Create-Lessons (teacher modifiable) Hartley Courseware, Inc.

ADDITION

Grade K Given a set of objects, the learner will construct a set that has one more object than the given set	Early Childhood Learning Program *Educational Activities
Grade 1 Given an addition fact in horizontal or vertical format, sums through 12 the learner will identify the sum	Alien Addition/Alligator Mix Developmental Learning Materials (DLM) Spaceship Minnesota Educational Computing Consortium (MECC)

Grade 2 Given an addition fact in horizontal or vertical format, sums through 18, the learner will identify the sum.	Math Blaster *Davidson and Associates Mathsheet (teacher tool) *Houghton Mifflin
Grade 3 Given (two) two and three digit addends with no regrouping, the learner will identify the sum.	The EA Mathematics Worksheet Generator (teacher tool) *Educational Activities Monster Math IBM *IBM Software
Grade 4 Given an addition problem with two or more regroupings, the learner will identify the sum	Mathsheet (teacher tool) *Houghton Mifflin The Game Show (teacher modifiable) *Advanced Ideas, Inc. Create-Lessons (teacher modifiable) *Hartley Courseware, Inc.
Grade 5 Given an addition problem with three or more four-digit addends, with and without regrouping, the learner will identify the sum	Mathsheet (teacher tool) *Houghton Mifflin The Game Show (teacher modifiable) *Advanced Ideas, Inc. Create-Lessons (teacher modifiable) *Hartley Courseware, Inc. The EA Mathematics Worksheet Generator (teacher tool) *Educational Activities
Grade 6 Given two addends 0-1000, the learner will estimate the sum by rounding	Create-Lessons (teacher modifiable) *Hartley Courseware, Inc. The EA Mathematics Worksheet Generator (teacher tool) *Educational Activities
Grade 7/8 Jr. High Given any addition problem involving decimals, the student will be able to find the sum	Survival Math Travel Agent, Hot Dog Stand *Sunburst Communications Adding Decimals *Microcomputer Workshops

GEOMETRY

Grade K Given a pictured object, the learner will identify the position above and/or below	Run Robot Run Reddy the Robot *Educational Teaching Aids Juggle's Rainbow *The Learning Company Young Folk Series Puss in Boots *Island Software
Grade 1 Given examples of a square triangle, rectangle and circle, the learner will identify the correct figure	Gertrude's Puzzles Gertrude's Secrets *The Learning Company Logo Spatial Relations Geometric Shapes *Aquarius Publishers, Inc.
Grade 2 Given a set of figures, the learner will identify the the figure that is open or closed	Koala Pad Touch Tablet *Koala Technologies Corp.
Grade 3 Given a square coordinate grid, the learner will locate and name	Mathematics Activities Courseware 4 Coordinate Concentration *Houghton-Mifflin Bumble Games Find the Bumble Butterfly Hunt Visit from Space Tic Tac Toe Bumble Dots *The Learning Company
Grade 4 Given models of three dimensional shapes, the learner will identify the sphere, cone, cylinder, cube and pyramid	Spatial Relations Three Dimensions *Aquarius Publishers, Inc.
Grade 5 Given ordered pairs of numbers, the learner will locate points on a grid	Coordinate *Microcomputer Workshops

Grade 6 Given a set of angles, the learner will identify the right angles, acute angles, and obtuse angles	Mathematics-Volume 8 - Angles *MECC Geometry Alive! Circles *Educational Activities
Grade 7/8 Given a regular geometric figure (square, rectangle, parallelogram) the student will be able to find the area of that figure	Mathematics Activities Courseware 4 Area Estimation *Houghton-Mifflin Mathematics - Volume 3 Trapezoid and Triangle Areas Parallelogram Areas, Rectangle and Square Areas MECC

MEASUREMENT

Grade K Given a set of three coins (penny, nickel, dime), the learner will identify and name each coin	Mathematics: Grade 1-disk 2 *Intellectual Software Money! Money! *Hartley Courseware, Inc.
Grade 1 Time: Given pictures of clock faces, the learner will identify the time to the hour	Clock *Hartley Courseware, Inc. A Tick Tock Tale *Hickory Stick, Inc. Time Master *Micro Power & Light Company
Grade 2 The learner will identify the number of days in a week and name them in proper sequence	Calendar Skills *Hartley Courseware, Inc.
Grade 3 The learner will identify the number of days in a year, hours in a day, minutes in an hour	Calendar Skills/Clock *Hartley Courseware, Inc. Time Master *Micro Power & Light Co.
Grade 4 Linear: given a set of objects or lengths and a centimeter ruler, the learner will measure to the nearest centimeter	Elementary-Volume 1 Metric Estimate, Metric 21 MECC

Grade 5 Linear: given line segments and a ruler calibrated in millimeters, the learner will measure to the nearest centimeter	Metric IV (IBM) Reading a Metric Ruler *Classroom Consortia Media Elementary Volume 1 Metric Estimate, Metric 21 MECC
Grade 6 Perimeter: given a set of objects or shapes, the learner will identify the perimeter of each in centimeters	Mathematics Activities Courseware 4 Centipede Racers *Houghton Mifflin Metric IV (IBM) Perimeter Calculations *Classroom Consortium Media
Grade 7/8 Given a statement, the student will be able to select the appropriate unit of metric measure	Explorer Metros: a Metric *Sunburst Communications
Given a line, circle or bar graph, the student will be able to answer questions related to the information contained in the graph	Easy Graph *Grolier Electronic Publishing Exploring Table and Graphs Level 1,2 *Weekly Reader Family Software

FUTURE LEARNING DELIVERY SYSTEMS

By: Alfred Bork, Educational Technology Center, Information and Computer Science, University of California, Irvine, CA

The outstanding technology of the twentieth century, and perhaps for several centuries, is the digital computer. Although the computer is new, available commercially for about 30 years, it is found in every aspect of society. Its implications for our society are little understood.

My concern is education. We have within our grasp the possibility of major improvements in the way people learn, in all areas, in all subjects matters, in all economic classes, and in all parts of the world. We can transform the learning process, making it more attractive, more efficient, and more powerful.

It is not clear that we, the human race, will be wise enough to do this. The computer, like all technology, is only a device. Its effective educational use demands the best decisions by human beings, decisions based on current situations, problems in learning, and the full potential of the computer. Many current directions are not desirable.

To explain the powerful potential of the computer in remolding future education, I begin by reviewing a set of modules developed at the Educational Technology Center at the University of California, Irvine. Then, in the second section, I will examine the future and indicate some exciting possibilities if we can use the computer well. I will also indicate the major problems that we face.

AN EXAMPLE OF THE COMPUTER IN LEARNING

My example is the Scientific Reasoning Series, twelve programs supported by the National Science Foundation and the Fund for the Improvement of Post Secondary Education. The average student time for these programs is approximately twenty hours.

The programs address the nature of scientific knowledge. They raise, indirectly, deep questions about what is a theory, how theories are connected with experience, how we verify theories, and the predictive power of theories. Their main goal is to aid people to think and reason the way scientists think and reason. The age level is from about 12 years up. The programs have been used successfully in adult education as well as with junior high, high school students, and university students.

Like other good computer based learning, these materials are highly interactive. The student is asked to do something roughly every 15 seconds. The student does not see books or films on the screen, but experiences a unique active learning experience adapted to the new learning medium.

To be more concrete, consider one program, HEAT. Its main intent is to bring students to an understanding of how the scientist goes about constructing new scientific concepts. The concept is not introduced by "definition", as often happens in our classrooms; rather it is introduced through "empirical" investigations which suggest the usefulness of such a concept.

HEAT starts with a review of temperature, measured by thermometers. The student considers kitchen physics experiments, involving hot water, cold water, thermos bottles, water on burners, ice cubes in water and other such components. The student, playing a very active role in the process, begins to understand that temperature alone is not adequate to account for the phenomena. The new concept, HEAT, is gradually approached.

HEAT asks English questions and expects English responses. Thus, the program is truly a **dialog**, a conversation, between the authors of the program, and the individual student or a group of students a dialog mediated through this new and powerful medium, the computer. Thus powerful teachers, who design such computer dialogs, successful with the Socratic approach to learning, can access a much larger audience than their own classes.

FUTURE TECHNOLOGY BASED DELIVERY SYSTEMS

We have a few examples of educational systems heavily based on the computer. A few full computer based courses have been developed. We can envision at all levels an extension of the procedures of the Open University in Great Britain, now based primarily on print material, to a system using on computer based material. The Open University is a learning at a distance system, delivering quality education at significantly lower costs than our typical student campuses. Interesting future school systems are also described by George Leonard In Education and Ecstasy, and in the April, 1984, issue of Esquire magazine.

I will not describe these systems, but will outline goals obtainable through a wide use of technology in education. In the last section, I discuss problems to be overcome to create an educational system realizing such goals.

1. **Education can be enjoyable.** This does not mean that education should be only games. The use of game-like material, with little learning aspects, is too common at present. But it is possible to develop systems with greater motivational strength than our current book-based and lecture-based delivery systems. Educational activities can be interesting, so students will be motivated to spend more time in the learning process. Time on task is an important factor in how much students learn, so the amount of learning increases if learning is more interesting.

2. **Education can be active.** Each student can play an active role in learning rather than the typically passive role in our systems today.

3. **Education can be individualized.** Each student can receive unique educational experiences adapted to the needs of that particular student. This is a consequence of interaction; at each moment we know what learning problems the student has. We can give more than lip service to differences between students.

4. **Education can achieve mastery.** Every student can learn everything. There is no reason for failures. A variety of learning experiences allow each student to be treated in a way best for that student.

5. **Students should work at individualized paces.** The concept of classes, such as first grade, can be avoided easily.

6. **Teachers should work individually with students.** Students in difficulty need to receive individual attention from the teacher, often impossible in the twenty five student classroom.

7. **Learning can take place in various environments.** Some of the learning taking place in schools might move to public environments such as libraries, or to the home.

8. **The results of education can be known.** A computer based management system can tell teachers, supervisors, parents, and students when their actions are needed.

All these goals are attainable in the school of the future. The critical factor is the widespread use of good computer based learning modules. The two schools described in detail by George Leonard are interesting approaches. But other ways of organizing our educational system might also lead to these goals.

Problems and Solutions

It is by no means certain that the computer will be used effectively. The schools of the future, using computers, may be no better, or worse, than the schools of today. Current computer modes are inadequate to the problem.

We cannot achieve these goals with the current courses, curriculum, schools, and teachers. Major transformations must take place in our educational system.

A number of important issues need to be considered. How do we acquire the new curriculum materials? To achieve mastery, to let students learn at their fastest rate, to keep education interesting, **we need an entirely new set of courses**, several in each area that assume from the beginning that the computer is one of the important learning media available. This is not to say that books, films, and other learning modes will not be available - I expect they will be - but they will play a less important role in the new system. Developing this new curriculum material, from earliest education through the university, is **essential** in forming a new learning system.

We have the capability for producing this new curriculum. The production of extensive new curriculums is not easy, but it is possible. Leadership and financial resources are the major problems.

What steps do we take to work toward this sizable development? First we need a **testing period**, of about six years, to experiment with the use of full scale computer-using courses involving students, and to experiment with procedures for development of such courses. Approximately twenty courses should be developed and fully tested in ordinary classrooms over the six year trial period.

We require a full summative evaluation of these courses. We need to study carefully the developmental process. Several hundred million dollars will be required for this trial period. This is a relatively small sum of money compared to many other major projects. Such a preliminary period will tell us whether such courses work with students, and will prepare us for the possible full scale development to follow.

The next stage will be that of obtaining sufficient funding and resources for the full process. Then finally, over a seven to ten year period, we could complete the large scale development activities.

Clearly sizable expenditures, such as those required for this project, will not be possible unless we convince the people, and through them the state and federal governments in this country, that **education is important.** Hence a new approach is needed to get the country to understand the long-range value of education. If the country sees education as an important activity, at least as important as the military forces, we will be able to work toward an improved educational system.

WRITING PROCESSORS: "GHOST WRITER"

By: Robert Bortnick, Elk Grove School District #59, Arlington Hts., IL

Word processing is becoming as common an activity in schools as it has already become in offices. Word processing has demonstrated its usefulness in developing student's writing from the standpoint of increased interest in writing, greater creativity, and substantially more time spent on writing and rewriting activities. However, the teacher is the main ingredient in students' improvement in writing and that improvement is dependent on the frequency and quality of feedback that students receive on their writing.

In District 59 a second computer lab devoted to word processing and the support of the English curriculum has been added. The labs that already exist emphasize computer literacy which introduced programming, computer awareness, and word processing. This new word processing lab has enabled the computer to be fully integrated as a tool into the English classes where such a facility is available. What remains is the need to provide the quality and frequency of feedback to students on their writing. Programs that provide students feedback on their spelling, grammar, and even style and organization do exist. However, with the exception of spelling checkers they are not presently available in a cost effective manner for schools. The best example of such a program is "Writer's Workbench". This program requires larger hardware investments than an Apple and requires a level of sophistication that the vast majority of English teachers do not possess nor have any desire to acquire. Therefore, in our district a project by two staff members, Dr. Bob Bortnick and Thomas Lundeen, has resulted in a software program available on the Apple that has demonstrated its usefulness in doing some of the more mundane feedback activities. This allows the English teacher to concentrate on the higher level characteristics of good writing, including unity, coherence, and logic.

Specifically, "Ghost Writer" has the following advantages:

1. The ability to run on an Apple IIe or IIc system, one drive, 64K systems.

2. The ability to analyze passages from several of the most popular word processors.

3. A set of utilities that are easy to use and provide high speed analysis due to the incorporation of extensive machine language routines. The feedback that "Ghost Writer" provides includes assessment of writing in terms of national standards and longitudinal development.

"Ghost Writer" contains a set of utilities that provide the writer with feedback on a number of aspects of their writing related to its readability, acceptability, and clarity. These utilities are each briefly described below:

MAIN MENU

Which test would you like to perform on Essay 1? [ ]

[1] Bormuth Test Readability
[2] Sentence Length Analyzer
[3] Paragraph Outliner
[4] Homonym Checker
[5] Clarity Checker
[6] Vocabulary Analyzer

[7] Analyze another passage
[8] Change printers
[9] Quit

SUB MENU

Which of these do you want? [ ]

[1] Description
[2] Analysis
[3] Suggestions

[4] Return to the Main Menu

READABILITY TESTS
Passage: Essay 1

Description:
The "Readability Utility" indicates the level of difficulty in reading your composition. Remember that readability levels are only estimates. This utility gives three readability estimates. Generally, you should use the "independent level" to judge your composition.

Each readability score is given as a grade level. For example, a grade level of 8.2 means that students in the second month of the eighth grade would read your composition easily. The readability of your composition should be within a year of your present grade level.

SENTENCE LENGTH ANALYZER
Passage: Essay 1

Description:
The "Sentence Length Utility" provides a graph of the sentences you have written paragraph by paragraph. The total number of words in each sentence is in the right hand margin.

There is also an indication of which sentences come closer to the length found to be good and poor in national studies of students at a particular age level.

Good writers use a variety of sentence lengths. Make sure you write sentences that vary in length. These sentences are averages. Good writers have short sentences in with their longer ones.

PARAGRAPH OUTLINES
Passage: Essay 1

Description:
The "Outliner Utility" provides an outline of your composition. The first and last sentences of each paragraph are printed completely. Sentences in between have dashes for each word in the sentence, and display punctuation marks. Conjunctions are printed as they actually appear. Remember, conjunctions are words in the language which connect and relate ideas. They help provide a logical structure to your writing.

HOMONYM CHECKER
Passage: Essay 1

Description:
The "Homonym Checker" will check those words in our language that are pronounced the same but are often spelled differently, and always have different meanings.

For example: to -- in the direction of
two - a number
too - also, very

"Ghost Writer" has over 500 homonyms it will check in your writing. These words are commonly misspelled and/or misused in writing at all levels.

CLARITY CHECKER
Passage: Essay 1

Description:
The "Clarity Checker Utility" provides a listing of each sentence of your composition. In addition, it identifies prepositions, "to be" verbs, subordinating and coordinating conjunctions, and nominalizations. All of these are marked for you to review. At the end of your composition, a summary of the frequency of the occurrence of these elements is provided. You also receive an index that estimates the maturity level of your writing. The higher the index, the better your writing is likely to be.

VOCABULARY ANALYZER
Passage: Essay 1

Description:
The "Vocabulary Analyzer" gives you the frequency of the words that you have used in your writing. The "Vocabulary Analyzer" also counts the number of different words and compares it to the total number of words in the composition. The higher the index, the more variety of words that you have used to convey your meaning. A higher index indicates that you have a broader vocabulary and your writing will often be more effective.

In summary, "Ghost Writer" provides an important step in giving students feedback on their writing and to assist in the development of their writing skills. The program is cost effective in schools today with most common word processors and hardware configurations available. Most importantly, "Ghost Writer" provides a means of both assessing student's growth while assisting the teacher in providing the important quality feedback necessary for students

to continue to develop in their ability to effectively communicate through their writing.

For those interested in "Ghost Writer", contact:

MECC
3490 Lexington Avenue North
St. Paul, MN 55112

A ProDOS 128K Apple version and expanded IBM version are now under development. For further information contact:

Dr. Robert Bortnick
School District 59
2123 S. Arlington Hts. Road
Arlington Hts., IL 60005
Phone: (312) 593-4328

COMPUTERS AND YOUNG CHILDREN

By: Barbara Bowman, Erikson Institute, Chicago, IL

Computers are recognized as the heralders of a world-wide technological revolution, and proficiency with this new tool is postulated to be the sine quo non for successful participation in the economic and social systems of the future. Planning for children to become competent users of the new technology is essential. In the study COMPUTERS AND PRESCHOOL CHILDREN by Olive Harvey, Community College and Erikson Institute For Advanced Study of Child Development, we consider when and how this competency should be initiated. The Computer Project is a preliminary attempt to document how and what young children can learn about computers when they have an opportunity to use them in an informal setting. The purpose of the project is to develop a framework for understanding how four and five year old youngsters might best begin their technological education.

There is considerable controversy over whether or not it is useful to provide computer experience for four to six year old children. Many teachers, school administrators and parents, are willing and often eager for young children to get an early start. On the other hand, some child development experts caution against or discourage computer programs for young children, contending that these experiences will not hasten skills and understanding and may, in fact, imperil the normal social and cognitive development of the child.

Advocates of early computer exposure have identified three ways in which computers can be used by young children. They are recommended as an easy and enjoyable way to teach children information and skills. In this format computers are preprogrammed to provide children the right answer to stimulus questions, hence the term electronic work sheet has been applied. Another use being recommended for young children is "the computer as a tool." Used in this way, the child harnesses the capability of the computer to produce his own work more easily. Pallets, word processing programs, microworlds, all provide playful opportunities for children to create, construct and compose ideas for themselves using this modern technology. Finally, it has been suggested that children can learn to program computers, thereby learning how to control the tool they use. Proponents of this position contend that early competence is advantageous for children because it stimulates the development of the skills that underlie the new technology, skills of engaging a mechanical device to symbolize human thought. These skills include particular ways of organizing ideas and stylized ways of interacting with the machine which are not dissimilar to the skills underlying other complex skills such as reading and writing.

The notion that preschool aged children can profitably spend time on computers has been challenged sharply by a number of child development specialists (Barnes, Cuffaro). They point out that most preprogrammed software seldom teaches anything which cannot be better learned by children using concrete materials. They also believe that the knowledge and skill necessary to program computers (acquisition of computer language and metacognitive ability) are beyond the capability of most preschoolers and that time spent teaching children to program would be taken away from activities which are developmentally significant. The analogy may be made to formal instruction in reading, which most child developmentalists oppose, where the gains in reading skill which can be made by children between four and six are not considered

worth the time given to the activity. This developmental perspective stresses the importance of exploration and experimentation with concrete objects as the best possible preparation for learning abstract symbolic systems.

The major points in the developmentalist position are the following: 1. Most preschool aged children are not able to achieve much skill in computer programming; 2. Skills presented in preprogrammed software are as easily, if not better, taught in other ways; 3. Computers are justified only after all other components of a good preschool program are in place: adequate equipment and materials, decent pay and good training for staff.

The present study does not challenge this wisdom. Rather, it seeks to extend the parameters to be assessed in order to be sure that there is no hidden curriculum which some children receive as a consequence of playing with computers in a responsive environment. Instead of confining our attention to specific outcomes, the entire process by which young children becomefamiliar with a complex skill was considered. What stages do children go through as they become familiar with computers? What do they understand by what they do? How do they see themselves in relationship to computers? What skills do they develop that indicate developing understanding? What collateral activities support their understanding of computers? These are the questions which underlie the study.

The study was conducted at the Olive Harvey Community College Child Development Center. Four and five year old children were encouraged to use one of the two Apple IIe computers available during free play time. The computers were loaded with Terrapin Logo and other graphics programs. Demonstrations and sample programs were given to the children as they seemed interested.

Since the purpose of the study was to try to understand what children were learning from what they were doing, the project staff's role was to observe and question the children. Project staff met frequently to discuss observations, develop hypothesis about the meaning of the children's behavior, and then to observe again to test the hypotheses. Several videotapes and audiotapes were made and analyzed.

SUMMARY OF FINDINGS:
The children learned about computers just as they learned about other aspects of their world. These ways of knowing can be categorized as follows:

CATEGORY I KNOWS ABOUT (STAGE 1)
The child learns about computers as an artifact/activity of the adult culture about which the child only grasps concrete and perceptual aspects. The child begins to see him or herself as a member of the community of users or doers.

When children observe an adult activity that is complex they begin to learn about it by imitating what they consider the relevant aspects, the perceptual aspects, of that activity. This is the kind of behavior we see when children pretend to drive or keep house or "be doctor". The child sees and imitates acts he or she think important; thus, the driver swears, the mother rocks the baby, the doctor carries a bag and puts something in his ears.

This was the initial phase for all the children. They sat at the keyboard and pushed keys, sometimes filling the entire monitor. They explored the computer

by focusing on the obvious opportunities to "make something happen" through their own motor activity.

CATEGORY I KNOWS ABOUT (STAGE 2)
Without understanding how or why the computer works, the child learns to use it as a tool for personal ends. The child accepts himself as one who can make the computer work.

Many complicated and complex machines perform tasks which are not easily understood by young children, but are useful to them. The internal mechanism is too hard for them to grasp, but they can make it do what they want it to do. They learn a rote set of procedures which get the desired results and they don't worry about understanding how the thing works. Children flush toilets, turn on record players, and push buttons to control elevators. They are often interested in the mechanism of control, but are usually satisfied to use the object using rote learned procedures.

Children learned to use the computer this way. They learned to turn it on, load the disk; they touched keys in order to write the words they wanted to appear on the screen. They were able to make things happen and seemed to derive considerable pleasure from doing so.

CATEGORY II KNOWS HOW
Children break the code and discover non-perceptual features to a complex task.

Breaking the code is the step which allows the child to make sense of an activity and to control it from some logical understanding rather than learning specific steps by rote. There are two major skills required for the children to break the LOGO code: they must be able to conceptualize a problem in a particular way (determine the steps needed to lead to a specific end product); and they must be able to tell the computer to perform the necessary operations, i.e., speak computer. (For this generation of computers, speaking computer means also mastering the symbols, letters and numbers, in which computer language is encoded.)

Gradually most of the children moved to the stage in which they began to break down the global understanding of the computer as a machine that does a few specific things to a more refined idea of what the computer could do, and the mental operations necessary to accomplish these new tasks. The children developed an overview of the process of creating computer graphics as they acquired relevant subskills. As children used the computer, they skipped about from one aspect of the activity to another. Sometimes loading the disk held their attention; other times it was letters and numbers, or the patterns themselves. It was often difficult to decide whether children were learning a subskill by rote or really understood the relationship of the subskill to the whole. Sometimes children became interested in particular subskills (the repeat function, wrapping lines around). They would pursue these for a while, often teaching what they learned to other children, then move on to another component or repeat already learned routines. There was a constant interplay between the overview and what the children thought were relevant subskills.

CATEGORY III LEARNS FROM
Computers can be used as a vehicle for teaching other concepts or information.

1. Symbols
Without question, playing with the computer heightened the children's interest in learning letters and numbers. Perhaps because the computers provided concrete evidence of the usefulness of symbols, it seemed that most children learned both the name of letters and numbers and the difference between them more readily than had occurred in prior years.

2. Mathematical Relationships
Learning math concepts from computer graphics is similar to how children learn length relationships from unit blocks, numbers from an abacus, and shapes from puzzles. Activities engaged in by children for "fun" or in "play" teach relationships inherent in their use of structure. Papert, in his book MINDSTORMS, contends that one of the benefits of using LOGO is that children can experience powerful mathematic ideas in concrete representation. Papert suggests that this syntonic way of knowing abstract ideas leads to better understanding.

Children did learn some mathematical relationships from using the computers. Children learned the relationship between the length of a number one and the size of the number entered. Some of them also learned that to add zeros to the number one would increase the length of the line, which would be made to wrap around the screen. Further observation is needed to ascertain whether these discoveries of the children represent a significantly different way for children to understand these relationships than the understanding that comes when children have not had the experience with computers.

3. Social Attitudes
The children learned that playing with computers could be an interesting and enjoyable activity. All of the children used the computers, but some were much more enthusiastic than others. The computers were almost always a social activity with interchange between teachers and children. Children asked for (and got) encouragement and positive feedback from teachers and parents for their computer interest and accomplishment.

SUMMARY
Perhaps the most important question that this year of study answered is that computers can be introduced into a preschool classroom without interfering with the social and cognitive opportunities traditionally provided. the OLIVE HARVEY CHILD DEVELOPMENT CENTER children and their parents enjoyed the exposure to "the new technology" within the parameters of a developmentally oriented program. Resources are the critical factor, and where these exist in both money and teacher interest, we can add to our knowledge about how children learn by observing their interaction with computers.

In the year of observation we developed more questions than answers. Perhaps the most important issue is how to collect data which will give a clearer answer to the question. "What do children understand from informal opportunities to become familiar with technology." The difficulty of keeping good records amid the bedlam of a typical day with young children made it difficult for teachers to bring their exceptional understanding of the children to such a project and still fulfill their roles in the classroom. Video and audiotaping are clearly needed to assist in the collection of good

data. Teacher interpretation of both their own and the children's motivation and thinking, adds richness to the usual tape-coding protocols.

Belonging to a Community of "Doers"

The children learned some general things about computers, a few of the skills needed to program, the social roles and appropriate behavior as defined by their teachers. More important, perhaps, the computers became part of their daily lives. In play, in conversations at group time, in their reports to their parents, computers and themselves as users were frequent themes. The children (and their parents) thought of themselves as part of the "community of doers" and as developing competency in the new technology.

Children at play repeatedly give us evidence of how they adopt half-understood facts and relationships in the effort to make sense of them. Through play they try not only to understand the activities of the adult world, they project themselves into controlling roles so that they are the doers and users. Presumably, this projection of self into roles not only opens up new vistas of understanding of the activity, but also extends the child's concept of him or herself in relation to the activity.

Playing with computers in school offered these children a small insight into the real nature of computer technology and the relationship of people to it. It also enabled them to think of themselves as users of computers.

Is this sufficient learning to be worthy of the time and resources allocated to computers. Work on the complex nature of symbolic activities such as language acquisition, reading, and writing provides a useful framework for considering early computer experience. Children who have ample opportunity to explore reading within the contest of socially relevant experiences; who understand the skill as a social event rather than as a collection of discrete subskills; who expect to derive personal benefit--such children are more eager to learn to read and end up being more competent readers. It is the early emotional/social/cognitive interaction that presumably is a critical factor in the ease with which some children learn to read well as compared to children whose environments do not stress this interaction.

Learning to use computers may not be different. The experiences necessary to become a competent computer user may be similar to those essential to literacy--opportunity to gain an overview of the process, expectations that one will be a user, a chance to explore the perceptual and non-perceptual aspects of the activity. These are the experiences children are apt to have when computers are a part of their home environment and what may be missing for many children.

Observation and documentation are needed to define more clearly the precursor activities that will lay the ground work for later computer competence.

DEVELOPMENT & IMPLEMENTATION OF INTERACTIVE VIDEODISCS IN EDUCATION

By: Sharon E. Brown, NCR Technical Education, Miamisburg, OH

Often in the excitement of new technology, we tend to rush to be involved without thinking through all the implications. Interactive videodiscs offer so many instructional advantages that we eagerly "jump on the band wagon" to bring the world to the student with the "touch of a single key", as so many articles promise. However, producing an interactive videodisc requires expertise in instructional design, video production and computer programming as they apply to the capabilities of this new technology. There are so many considerations that a hurried entry into the interactive videodisc production arena may defeat the future of this new technology.

An interactive videodisc project must begin with basic management and production skills in order to Analyze, Organize, Develop, Produce and Validate course development. This is a team process and each team member must comprehend the whole project as it will utilize the instructional advantages of the hardware, software and videodisc courseware. This will include the appropriate uses of interactive videodisc instruction (IVI), instructional advantages, return on investment and levels of interactive videodisc equipment configurations. When considering producing IVI, different methods of implementation should be explored. The system configuration must be selected with planning for future needs. Funding alternatives should be explored before beginning because this new technology is not inexpensive if produced with quality.

APPROPRIATE USES

If the appropriate use is not defined for IVI, a rationale for the cost of the production cannot be made. Applications that require instruction for large populations of students on subject matter that remains valid can be cost justified. Any subject matter that requires expensive instructional equipment will yield a positive return on investment. If the instruction endangers lives, involves travel costs or shortens student time on task, the rationale for IVI can be made. Combinations of each of these may be used to support IVI production.

INSTRUCTIONAL ADVANTAGES

IVI can be designed to incorporate all the advantages of self-paced instruction with those of computer management, content and audio visual presentations. In self-paced instruction (SPI), the student is in control through individualized presentations. Self-assessment is possible through exercises, pre and post testing.

Computer managed instruction (CMI) adds the ability to keep records of student files, track students' paths through the subject matter and updating. Information gathered may be used for course improvements and research. Computer assisted instruction (CAI) makes it possible to develop turnkey courseware. Diagnostic simulations and computer graphics will enhance the instructional quality.

The videodisc adds the ability to randomly access visual representations of content. THe large storage capabilities of the videodisc may be used for still frames and motion segments. Two audio tracks can be used independently to present different types of information to students. The instructional

advantages of these motivational qualities should not be underestimated.

RETURN ON INVESTMENT

IVI can include savings that justify the cost of implementation. This involves calculating the difference between the current method of instructional delivery with the proposed interactive videodisc delivery. The number of students, size of class, course days and course life must be considered. The cost of instructor delivery (includes salary and overhead) is compared with interactive videodisc delivery. Development and production costs must be calculated for comparison purposes.

Although savings are difficult to measure with intangible advantages such as freeing the instructor to cover more advanced subject matter, increased course availability and standardized presentation may strengthen the rationale.

INTERACTIVE VIDEODISC LEVELS

There are three basic levels of interactive videodisc equipment configurations. Level one equipment includes a commercial videodisc player and color monitor. The average cost is $900.00. The student can press numbers that advance the videodisc to "chapters" (linear video presentations) "picture stops" (single frame advances). No tracking is possible with this method of presentation.

Level two requires a commercial model videodisc player with a programmable memory and a monitor. The average cost is $2,000. A computer program is digitally encoded directly on the videodisc and is downloaded into the programmable memory in the videodisc player. Students can make selections that utilize branching and jump features. Data can be collected by attaching a printer.

Level three combines the videodisc player with a computer and a monitor. This is the most flexible equipment configuration and costs from $4,000 to $10,000. The instructional delivery methods are practically unlimited and it is possible to track students' test results and instructional paths. Peripherals, such as voice responders, printers, graphics tablets, modems and touch screens may be added.

IMPLEMENTATION

There are a variety of ways you can obtain interactive videodisc instruction.

Custom design locally: A team must be assembled to produce IVI. This method may yield what the instructional needs are for a specific group, but the cost of production will be higher because the audience will be smaller. Also the learning curve to put together such a team will be costly but not prohibitive. There are many video companies that have experience producing video tapes that meet videodisc mastering specifications.

Generic videodiscs: The number of generic videodiscs available is growing. These are usually produced for level one videodisc players, but can be reprogrammed for customized presentations. The videodisc is used much the same way a slide sync or filmstrip would be used. In order to use these videodiscs, the instructor must utilize an authoring system to program the instructional presentation. There are many authoring systems available at a reasonable cost. Instructors will need to take time to learn to use the authoring system just as they would any software program.

Sharing with industry or other educational institutions: Often videodiscs that are produced for industry are generic enough to be adaptable for other uses. The information may not be exactly what is needed, but will be less expensive because of the large production numbers. These are usually produced for specific level three systems which may be costly.

Contracting outside: Using companies that specialize in producing interactive videodiscs may seem expensive, and may be if you are not an educated buyer. These companies have paid for a team to go through a learning curve and will have cost effective production procedures. Communicating your needs may be the largest challenge.

Publishing house: These companies have a large audience base and can offer cost effective distribution. They have experience with books, videotapes and audio tapes and understand the educational market. Ask your local sales representative for a list of interactive videodisc courseware available. Making them aware of your needs may increase their efforts to produce interactive videodiscs.

SYSTEM CONFIGURATION CONSIDERATIONS

Selecting the correct equipment configuration for the hardware will present a challenge. Compatability of computer software and videodisc courseware for the hardware is a problem. The more courses available for the hardware enables a better cost justification.

Most people forget that the hardware and software may require repair or debugging. Be sure that the company you select provides service for both or you may have trouble getting the system to work. Choose a company that has experience in this industry and will stay in business. Updating the courseware may be necessary in the future.

FUNDING

Funding for special projects is available from State and Federal organizations. Private industries also may have grants available. Writing a proposal involves knowing if the companies' needs match yours. Many are willing to consider funding a project in return for research on the instructional advantages of interactive videodisc.

PRODUCTION RATIOS

When designing or purchasing an interactive videodisc product, make sure you know what you are getting. Many programs simply place existing linear videotapes directly onto the videodisc and write a program to access linear segments. This should be less expensive and is fine if this meets your needs.

If the program is highly interactive (frequent student interactions) and includes tracing test scores, time on task or student progression through the material, the cost of the course will increase but so should the effectiveness.

TEAM APPROACH TO PRODUCING INTERACTIVE VIDEODISC INSTRUCTION

One of the most difficult challenges in putting together a team to produce interactive videodisc is finding people with such diverse areas of expertise (instructional design, video production and computer programming) that can communicate. Locating people that have the energy and dedication to complete what will seem like impossible tasks is difficult. Each team member must be

willing to share credit for the final product.

As mentioned before, the project involves all the usual ingredients of good course development: Analysis, Organization, Development, Production and Validation.

Analysis: A complete analysis of the audience, task, cost of production and return on investment must be completed. The goals of the program must be understood and accepted by each team member.

Organization: The need to communicate large volumes of documentation mandate the use of a data base software program. In fact, anything that can be accomplished proficiently (scheduling, critical path analysis, project sheets, video scripting and editing) with a software program will save time. Make sure the software program does not increase your production time by giving the team time to learn how to use them.

Development: The instructional design should utilize all the advantages of each level of interactive videodisc that are possible. This will require that the team learn the capabilities of all the production areas. The team will meet during the analysis phase to communicate what is possible with the video production and computer programming.

Production: If the project is not planned to the smallest detail, correcting mistakes will take longer and cost more. The production includes video and computer programming. Be sure that the instructional design remains the deciding factor in the production phase.

Validation: A check disc will provide the opportunity to have students test the courseware. Suggestions for improvements can be made at minimal costs. A check disc can be obtained for $300.00 with a three day turn around time. The video quality will not be as good as the final replicated videodisc, but this is an inexpensive way to make sure the instructional design is complete, the video is in place, and the computer programming works. If you order 100 videodiscs, the cost per videodisc will be about $33.00.

SUMMARY:

The educational market is beginning to become aware of the advantages of interactive videodisc instruction. With future teacher shortages predicted, this instructional technology may aid the students needing remediation or further challenges. The courseware can be designed to concurrently meet the needs of both.

Currently there are some educational applications of the videodisc. College USA is a level one program introducing high school students to college campuses. The National Education Training Corporation and Sony have combined to support a study that will yield over 75 generic instructional videodiscs from colleges dedicated to researching appropriate applications in education. Generic level one videodiscs include subjects such as Videodiscovery's Bio Sci Videodisc and Life Cycles. There is a Space Disc series, and Math Assessment and Basic Fractions from Systems Impact. Many large state systems are creating consortia to develop courseware for interactive videodisc. There is an increasing awareness in the educational field and with the careful planning there is a future for interactive videodisc.

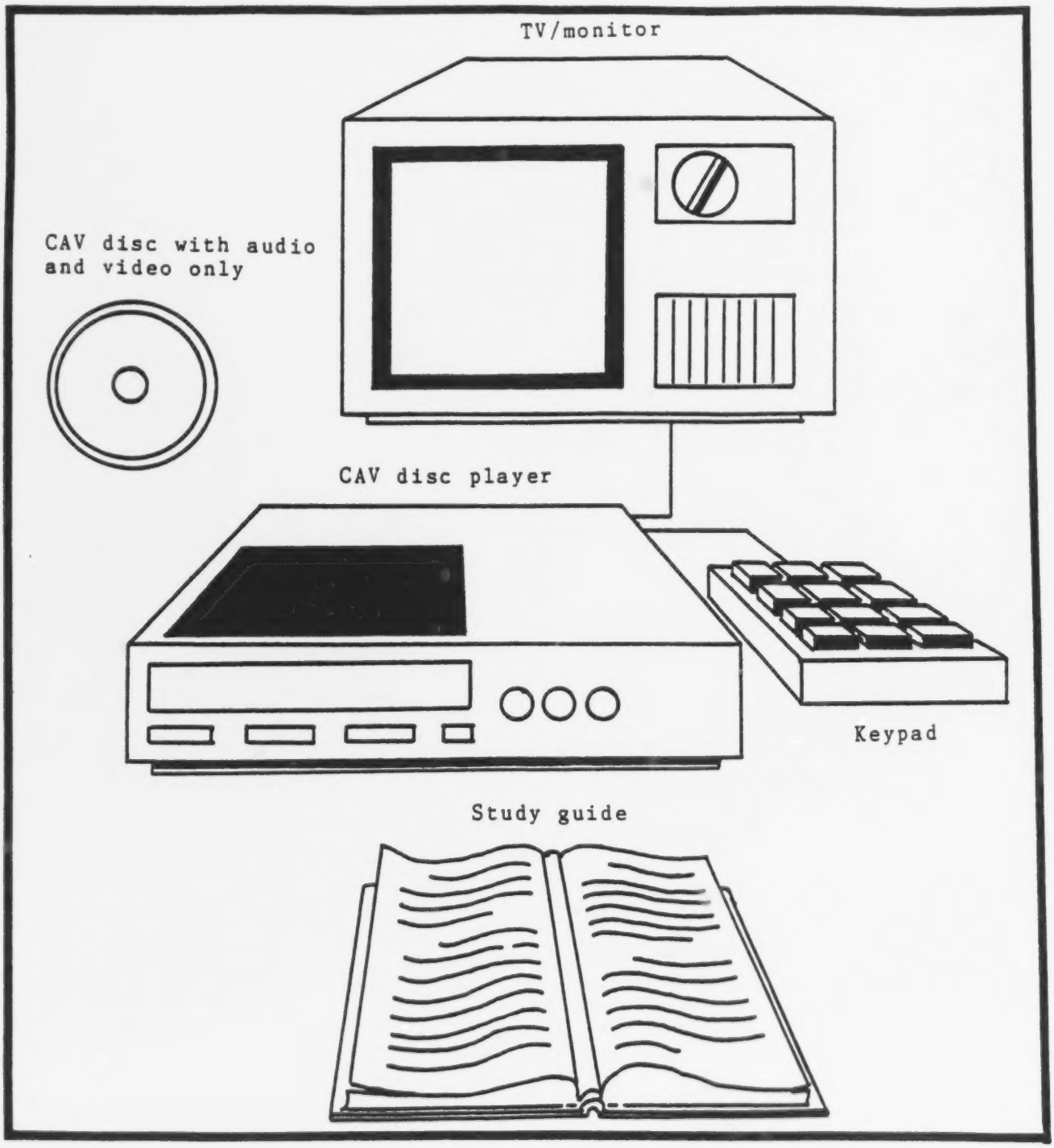

FIGURE 3. Interactive Videodisc System: Level One

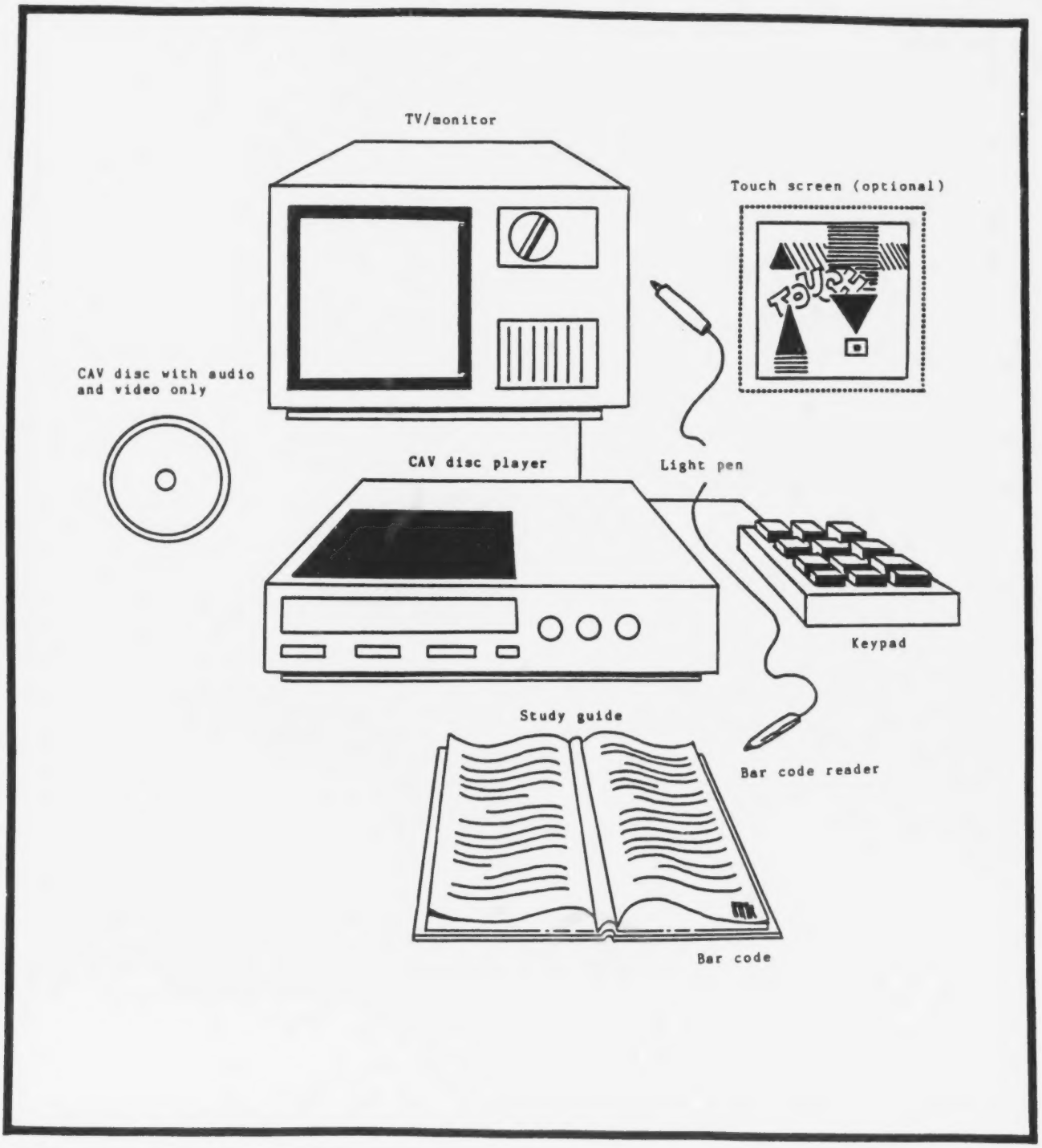

FIGURE 4. Interactive Videodisc System: Level Two

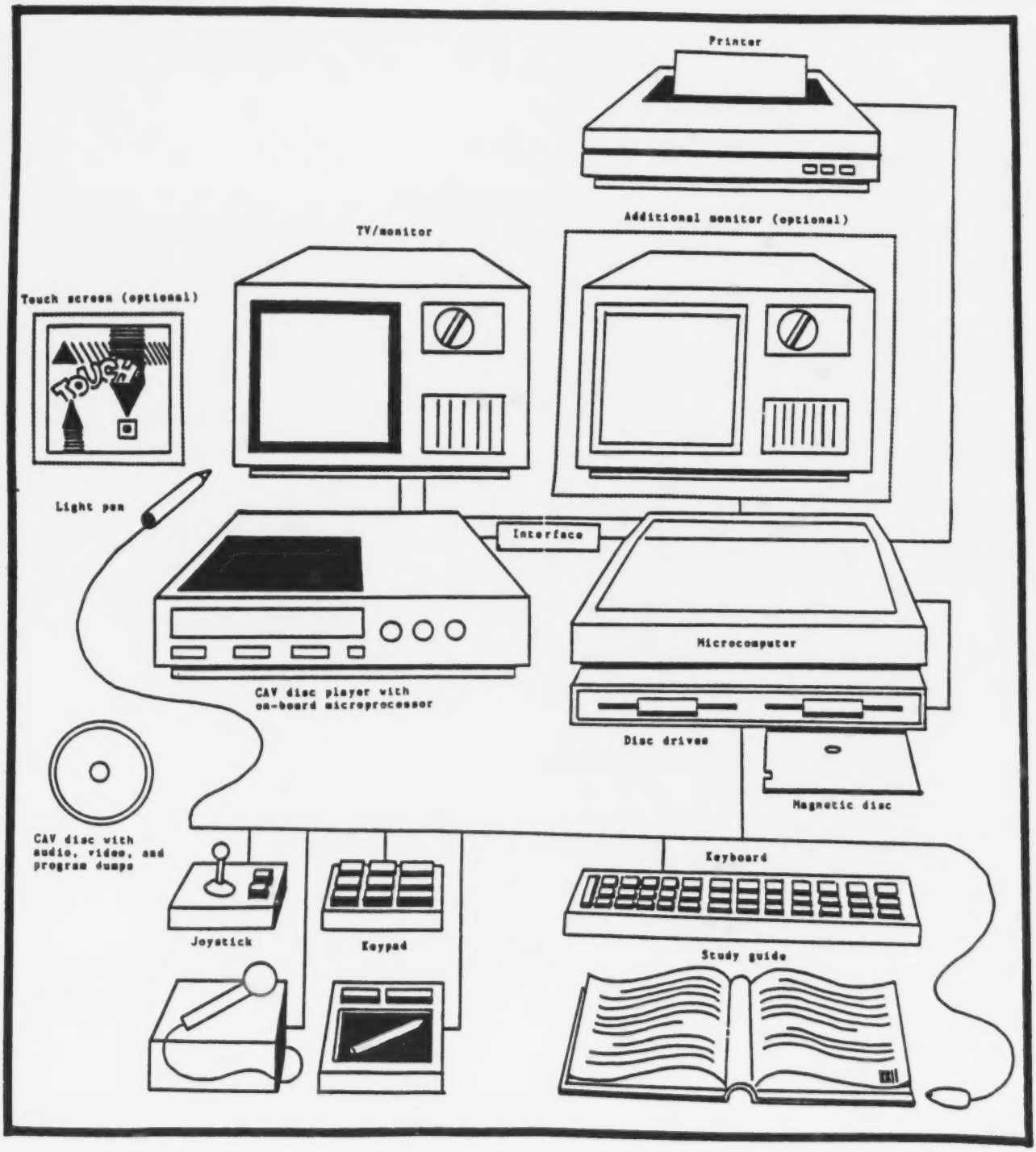

FIGURE 5. Interactive Videodisc System: Level Three

INTERACTIVE VIDEODISC SELECTED BIBLIOGRAPHY

INTERACTIVE VIDEODISC BOOKS

Daynes, Rod and Butler, Beverly. **The Videodisc Book: A Guide and Directory.** NY: John Wiley & Sons, Inc. 1984.

DeBloois, Michael L., Ed. **Videodisc/Microcomputer Courseware Design.** Englewood Cliffs, NJ: Educational Technology Publications, 1982.

Floyd, Steve and Floyd, Beth. **Handbook of Interactive Video.** White Plains, NY: Knowledge Industry Publications, Inc. 1982.

Parsloe, Eric, and Hoffos, Signe. **Interactive Video.** Great Britain: J. W. Arrowsmith Ltd., 1983.

Scartz, Ed. **Educational Handbook to Interactive Videodisc.** University of Delaware, 1985.

Schneider, Edward W. and Bennion, Junius L. **Videodiscs.** Englewood Cliffs, NJ: Educational Technology Publications, 1981.

Sigel, Efrem, et al. **Video Discs: The Technology, the Applications and the Future.** White Plains, NY: Knowledge Industry Publications, Inc., 1980.

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INTERACTIVE VIDEODISC PERIODICALS

AV Communications Review. Washington, DC Association for Educational Communications and Technology (AECT).

Electronic Learning. New York, Scholastic, Inc.

The Videodisc Monitor. Falls Church, VA 22046

Training and Development Journal. Madison, WI: American Society for Training and Development.

Training Magazine. Minneapolis, MN: Lakewood Publications.

Video Computing. Videosoft.

Videodisc Design/Production Group News. Lincoln, NE: Nebraska ETV Network/University of Nebraska--Lincoln.

TELECOMMUNICATIONS FOR EDUCATORS - AN INTRODUCTION

By: Paul C. Burton, Illinois Heartland Computer Consortium, Decatur, IL

The computer revolution in education is still in its infancy. The next step in the revolution's maturation process is the proliferation of telecommunications as an education tool. In order to take full advantage of the power of this developing resource, an understanding of the concepts and vocabulary associated with telecommunications is necessary. In the next few pages I will outline, in brief discussion form, the basic concepts and terms educators will find associated with telecommunications. A listing of telecommunications resources will follow the outline. Reference to good non-technical sources which discuss general telecommunications concepts and specific educational applications will be included in a supplementary listing. A concept/vocabulary curriculum for the movie WARGAMES is included as a supplement. Illinois educators desiring demonstration of telecommunications equipment or resources, or otherwise needing telecommunications consultation, are encouraged to contact their local computer consortium.

CONCEPTS AND VOCABULARY

TELECOMMUNICATIONS is defined as the combined use of communications facilities (the telephone company et.al.) and data-processing equipment (any computer or terminal). The basic idea is that two (or more) computers are connected via telephone lines. The telephone line is referred to as a (Tele) Communications CHANNEL, and is defined as a pathway that allows remote (far away) input/output devices (computers with keyboards, screens and printers) to communicate with other computers. In addition to the most common communication channel, the telephone line, there are many others including microwave links, satellites, and laser beams.

The purpose of joining computers via a communications channel is to exchange data. In order to accomplish the transmission of computer data via a communication channel, the appropriate Transmission METHOD must be used. **Analog**, the "continuous wave form" state of sound transmission, is required by the communications channel. The computer, however, only understands **Digital**, the distinct "on and off state" of each data bit. Transmission Methods SWITCHING is the process of changing from sound (analog), to computer (digital) and visa versa. **Modulation** is the term used to describe the converting of data from digital to analog (computer to telephone). **Demodulation** is, naturally, the term used to describe the conversion of data from analog to digital (telephone to computer). In order to accomplish the modulation/demodulation transmission method switching process, a transmission DEVICE is needed. This device is called a **MODEM** (MOdulation-DEModulation).

Once these physical elements of the telecommunications process are in place, transmission MODES are selected according to the nature of those elements. Modes, as well as a number of other variables - some of which we will touch on briefly in a moment - are selected using a communications program which works together with the modem. There are three possible modes which can be selected:

SIMPLEX - one way only transmission. (old teletype)

HALF DUPLEX - two-way transmission, but only one way at a time. (CB Radio)

FULL DUPLEX - simultaneous two-way transmission. (telephone)

Another set of variables which the communication software works with the modem to agree upon are the transmission RULES. Transmission rules are also called **PROTOCOLS.** A specification for the transmission FORMAT, the most important of which is transmission SPEED, is a protocol you set using your communications software. The two most common telecommunication speeds for microcomputers are 300 and 1200 baud. **BAUD RATES** refers to the number of changes per second, one baud being equal to one change per second, each change being a new bit being transferred. We will look at baud rates further in just a moment.

Another important set of variables in the telecommunications process are called PARAMETERS. Parameters include items like the number of data bits, stop bits, and parity that will be used in sending and receiving data. The nature of computer data is that each character in a set (such as each letter in the alphabet) is represented by a specifically organized coding scheme. The standard scheme used in microcomputers is called the ASCII (American Standard Code for Informational Interchange) code. Each number, letter, and symbol which is represented on a computer keyboard, plus several additional special control codes, is a represented character in the ASCII code. ASCII is a code with a 7 bit sequence. When selecting our parameters, then, we would normally choose 7 data bits if we were using the ASCII code. Additional bits may be for specific purposes. A PARITY bit may be added to help check for transmission errors. This is needed because telephone lines were designed for voice transmissions which do not react critically to line noise. Digital computer data transmitted via telephone lines does react critically to line noises such as static, thus necessitating error checking. Parity is either even or odd. When even parity is selected, the transmitting computer counts the number of "on" bits (ones) in each ASCII character, and adds a one if the number is odd, thus producing an even number of ones. If the computer receiving the transmitted ASCII character (also set to even parity) counts an odd number of ones, then it knows an error has occurred.

In addition to parity, START, and STOP bits may be added to the data bits. Their function is self-explanatory. They designate when an ASCII character begins and when it ends. Start bits (0) are immediately followed by the ASCII bits, the parity bit follows next, and last one or more stop bits are transmitted signalling the end of that character.

A very common parameter configuration is 300 bps, even parity, seven data bits, and one stop bit. Keep in mind that "common" in this case is dynamic as the industry changes and progresses.

With a basic understanding of bit transmission, let's reexamine baud rate and see if we can't make it more meaningful. By counting the number of changes per second, knowing now that each bit is one change, and that ASCII characters are represented by seven data bits, to which is added a parity bit, start bit, and one or more stop bits, we can easily calculate the approximate number of words per second that we are transmitting at each rate. (Don't forget that a space between words counts the same in the calculation as any other ASCII

character).

300 baud = 300 changes/7 bits (ASCII) + the three start/stop/parity bits (10) * 5 letters per word + a space between each word = (6 * 10 = 60) = 5 words per second.

1200 baud = 1200 changes/7 bits (ASCII) + the three start/stop/parity bits (10) * 5 letters per word + a space between each word = (6 * 10 = 60) = 20 words per second.

2400 baud = 2400 changes/7 bits (ASCII) + the three start/stop/parity bits (10) * 5 letters per word + a space between each word = (6 * 10 = 60) = 40 words per second.

The relative TIMING (SYNCHRONOUS or ASYNCHRONOUS) of telecommunication data exchange is a function of the configuration of the hardware (computer and modem) involved in the telecommunications process and is not set using the communications program. I list them here so you are aware of them, as they are often mentioned in telecommunications references. Almost all of the education related telecommunications that you will engage in with microcomputers will be asynchronous.

SYNCHRONOUS
Communications processes which depend upon the occurrences of specific events such as common timing signals. Used for batch transmission of blocks of characters in a continuous stream of bits involving buffered up and downloading. Instead of stop, start and parity bits the special control characters are sent which establish synchronization between the transmitter and receiver prior to the transmission of data.

ASYNCHRONOUS
Communications processes which does not depend upon a regular time relationship (most common on microcomputers). Any time lapse can occur between character transmission (obviously necessary when using keyboard input).

We moved very fast through rules! Be assured, however, that it is not as confusing as it may sound. The basic idea with rules and their description is not unlike the automobile transmission analogy. If you understand that moving the gear shift lever to "D" for drive will allow you to move forward, then a comprehensive knowledge of motion physics is not necessary. It is the same with telecommunications rules. The format protocol is simply the item that you select (like "D" for drive) using your communications program, to set the speed of transmission to the same as the computer you are going to telecommunicate with. You also select parity, start and stop bit format. Not too difficult! In may cases you will find that the communication software you are using DEFAULTS (pre-set) to the correct baud rate, parity, mode, and start and stop bits. Many good communication software packages allow you to build MACROS, each macro being a specific configuration of parameter/format which you call up with a single keystroke. You may have a dozen or more macros saved to diskette, each containing the correct configuration for a specific BULLETIN BOARD (bbs) or commercial system like THE SOURCE or COMPUSERVE.

Macros can also easily be designed to complete the entire log-on sequence (password, ID number, system number, etc.) with a single keystroke.

Telecommunications offers specific advantages to educators when compared to other resources. For example, it takes much less time to search a library catalog by computer than by card file; it would be virtually impossible to search the card files of all 25 of Illinois' Library Computer Systems (LCS) members by hand manipulation of each card catalog. Computer searches of all members can be accomplished easily from any access point. Thus SPEED is a primary advantage of telecommunications. Information such as that offered by LCS is available to anyone with the proper computer telecommunications equipment and access to a telephone line. It is obviously less convenient to drive to the library to do a catalog search than it is to walk to your computer and manipulate a few keys. ACCESSIBILITY is a key advantage of telecommunications resources. Because telecommunications resources are accessible from anywhere, a computer can be used with a telephone line, PORTABILITY is a major advantage. The nature of telecommunications equipment, computers with STORAGE capability, allows accessed information to be printed or saved at the users discretion. The elimination of extensive hand-written reproduction of text is a primary telecommunication asset. The transmission of knowledge has always been viewed as one of education's primary tasks, regardless of its transmission methods. Telecommunications, as the library search example demonstrates, is an extremely powerful medium for knowledge transmission. It is not, however, without its disadvantages.

Telecommunications equipment: computers, modems, peripheral storage devices, printers and communications software, as well as telephone calls and commercial subscription fees, are expensive to the point of being currently prohibitive to all but the most fortunate educators. However, like everything else in the computer industry, as development continues and competition increases, prices fall and services become more cost effective. The time is rapidly approaching when telecommunications will be accessible to the education community on a wholesale basis. Be prepared to take advantage of this marvelous instructional tool.

GENERAL PURPOSES OF TELECOMMUNICATION

1. Access Information Utilities
2. Connect to Electronic Mail/Telex
3. Exchange/Transfer Files
4. Call Bulletin Boards
5. Terminal Emulation (Phone/Direct)
6. Allow Limited Remote Access

CONCEPTS AND VOCABULARY

1. Telecommunications - The combined use of communication facilities and data-processing equipment.

2. Communication Channel - A pathway that allows remote input/output devices to communicate with other computers.

3. Analog - Transmission in continuous wave form.

4. Digital - Transmission in distinct "on" & "off" states.

5. Transmission Method Switching - The process of changing from sound to computer and visa versa.

6. Modulation - The term used to describe the converting of data from digital to analog.

7. Demodulation - The term used to describe the conversion of data from analog to digital.

8. Modem - (MOdulation-DEModulation) device used to accomplish the modulation demodulation process.

9. Simplex - One way transmission.

10. Half Duplex - Two way transmission, but only one way at a time.

11. Full Duplex - Simultaneous two-way transmission.

12. Transmission Rules - A set of variables in which the communication software works with the modem to agree upon.

13. Protocols - (also called transmission rules)

14. Transmission Speed - A specification for the transmission format.

15. Baud Rates - The number of changes per second.

16. Parameter - The number of data bits, stop bits, and parity that will be used in sending and receiving data.

17. Parity - The comparative odd-even relationship between integers.

18. Synchronous - Communications processes which depend upon the occurrences of specific events such as common timing signals.

19. Asynchronous - Communications processes which does not depend upon a regular time relationship.

TELECOMMUNICATION RESOURCES FOR ILLINOIS EDUCATORS

THE SOURCE
1616 Anderson Road
McLean, VA 22102
(703) 734-7500

SPECIAL NET
National Assn. of State Directors
of Special Education
2021 K St. NW Suite 315
Washington, DC 20006
(202) 296-1800

COMPUSERVE
5000 Arlington Centre Blvd.
Columbus, OH 43220
(800) 848-8990 or (614) 457-8650

Debbie Harshbarger, Director
EAST CENTRAL ILLINOIS MICROCOMPUTER CONSORTIUM
200 S. Fredrick St. Box 919
Rantoul, IL 61866
(217) 893-8481

John Flynn, Director
TRI COUNTY COMPUTER CONSORTIUM
Lewis Joliet Renaissance Center
214 N. Ottawa
Joliet, IL 60431
(815) 727-6544 Ext. 323

Paul C. Burton, Director
IL HEARTLAND SCHOOL COMPUTER CONS.
2240 E. Geddes Room 8
Decatur, IL 62526
(217) 424-3434

DIALOG
3460 Hillview Avenue
Palo Alto, CA 94304
(800) 227-1927

IEC/ECN
Cottonwood Office Center
Cottonwood Road
Edwardsville, IL 62025
(618) 288-7268

LIBRARY COMPUTER SYSTEM (LCS) FREE
Library Catalog - All Illinois Member Colleges and Univ. (25)
Example - UIUC - Gary Golden - Reference Desk - 333-1900
LCS - 333-2494

PUBLIC DOMAIN BULLETIN BOARDS
Compuserve MAUG XA4
Source PUBLIC 112

Legislative Information Service $500.00 year
705 Stratton Office Building
Springfield, IL 62706
(217) 782-4083 or 782-4084

INTRODUCTORY TELECOMMUNICATIONS - **WARGAMES**

1. VOCABULARY

   A. Words

      1. Silo's
      2. Impact
      3. Salacious
      4. Symbiosis
      5. Apogee
      6. Confidence
      7. Thermonuclear
      8. Fusion
      9. Acoustic
      10. Paleolithic
      11. Paleontologist
      12. Enable
      13. Trajectory
      14. Algorithm

   B. Acronyms

      1. M.I.R.V.
      2. I.C.B.M.
      3. S.A.C.
      4. MODEM

2. CONCEPTS

A. Words

1. Meditation
2. Chanting
3. "The Loop"
4. Sub-Launched
5. Seattle World's Fair
6. Data incription algorithms
7. Speech Synthesis - phonemic
8. A.I. Artificial Intelligence
9. Deep Logic
10. "Back Door"

B. Acronyms

1. M.I.R.V. - multiple individually targeted re-entry vehicle.
2. I.C.B.M. - intercontinental ballistic missile.
3. S.A.C. - Strategic Air Command - Hq. - Omaha, NE
4. MODEM - MOdulation/DEModulation

C. Concepts Vocabulary

1. Meditation - deep, deliberate thought contemplation.
2. Chanting - see Robert Heinlein's I Will Fear No Evil.
3. "The Loop" - the specified sequence of events and personnel used to launch one or more ICBM's.
4. Sub-Launched - ICBM's launched from submarines.
5. Seattle World's Fair - backdrop for old Elvis movies.
6. Data incription algorithms - method of hiding data according to mathematical logic.
7. Speech Synthesis - phonemic or pre-programmed word based sound generation intended to approximate the human voice.
8. A.I. - Artificial Intelligence - a branch of computer science aimed at producing human behavior and thought emulation by computers. (Eliza)
9. Deep Logic - CPU circuitry and its design.
10. "Back Door" - computer hackers term for circumventing established computer security measures via unlisted methods of access.

ADMINISTRATIVE USE OF APPLEWORKS

By: Bob Chinn, ABL School District #6, Broadlands, IL

APPLEWORKS, the integrated spreadsheet - data base - word processor, is well suited to complete a myriad of tasks in the school office. The flexibility, ease of use, and multitude of functions make this an ideal program for both the novice and experienced user.

After using APPLEWORKS for some time a striking difference of attitude is apparent in comparison with other programs. As a former user of MAGIC WINDOW (word processing), VISICALC and later MULTIPLAN (spreadsheet), PFS (simple data base) and DB MASTER (powerful but slow data base), I am now elated with using just one program - one set of commands - one common data format. All these other programs were held in high regard, but all shared one common problem - the more they were used, the more limiting they became. APPLEWORKS, on the other hand, is a program that grows in its capabilities and is adaptable to many situations.

LIMITATIONS OF APPLEWORKS

APPLEWORKS, as it comes packaged, is of limited use in the school office. Since data is memory resident, 55K is the limit of file size in a 128K Apple. Limitations of file length (word processor), number of records and fields (data base), and number of usable cells (spreadsheet) add to this problem.

A problem relating to file size is the small amount of available storage on the Apple disk drive (140K). The use of the new 3.5 drive which holds 800K, or a hard disk is a necessity for serious users.

One of the most striking omissions is the lack of mail merge capability - using the data base to define variables in a word processor document. Other items, such as Applewriter's glossary, a built-in spelling checker, MULTIPLAN's worksheet linking, and DB MASTER's password protection and ability to define pages of fields while error checking entries, are all worthwhile features presently NOT available in APPLEWORKS.

Because of its length and complexity, APPLEWORKS uses program overlays to conserve memory space. This means the program frequently pulls information from the disk during operation - a sometimes frustrating annoyance.

OVERCOMING THE LIMITATIONS

Many new and exciting add-on products are becoming available to overcome the limitations and enhance the use of APPLEWORKS.

The first, and probably most significant improvement, are the add-on memory cards. The 512K RamWorks card produced by Applied Engineering, for example, expands the APPLEWORKS desktop to 367K, allowing up to 5100 data base records or 5100 word processor lines. This is only the tip of the iceberg, however. Advertisements list up to 3 Megabytes of available expansion giving a 2277K desktop, 16,300 data base records and 16,300 lines in a word processor file! APPLEWORKS becomes a serious tool at this level. RamWorks also includes a utility to save large files on more than 1 diskette; a very important consideration if the file size exceeds storage capacity.

A second advantage of the RamWorks card is its ability to store most of the program in memory thus speeding up the movement of functions. This is at a price - the initial program boot process will be much longer since all the functions are loaded into memory at one time.

Adding the 3.5" disk drive or a hard disk (which also solves the speed problem) makes the storage of large files more practical. A disadvantage of the hard disk solution to the storage problem is the fact that the data must be backed up on more traditional media negating the primary advantage of speed. Also security of data may be a problem if unauthorized persons gain access to the system (removable floppies can be secured in a locked cabinet.)

Add-on software for APPLEWORKS brings the availability of mailmerge to APPLEWORKS. Four of the better known programs (SPELLWORKS, HABAMERGE, MEGAWORKS, and IAC MAILER) have limitations which complicate their use. All require leaving APPLEWORKS to run the mailmerge program, and SPELLWORKS and MEGAWORKS (which are very similar in many ways) require re-entering APPLEWORKS to print the merged files. (Incidentally, these two programs both require that data base file field names begin with "$$".) HABAMERGE and the IAC Mailing program print the merged letters, but care must be taken to maintain the length of word processor lines so margins will not be too large or overwritten. None of these programs allow selective inclusion of text. BASIC MAILER, a DOS 3.3 program designed to be used with MAGIC WINDOW, can also be successfully used, but it requires converting an APPLEWORKS text file from ProDOS to DOS 3.3. The only advantage is that features within BASIC MAILER allow selective inclusion of text. However, the restrictions noted for HABAMERGE and the IAC Mailing program also apply.

Several spelling checkers also exist to aid the APPLEWORKS user. These include MEGAWORKS, SPELLWORKS, and SENSIBLE SPELLER to name a few. All have slightly different ways of handling the situation, but all require leaving and then re-entering APPLEWORKS.

A new, exciting program has recently been introduced which further expands APPLEWORKS. PINPOINT actually adds desktop accessories that can be used while APPLEWORKS is in use, leaving data on the desktop in tact. The original program includes an appointment calendar, calculator, communications program, phone dialer, notepad, a quick label printer, and a utility to allow the merging of graphics into a word processor document. To top this, a user interface is available which will allow assembly language programmers to add additional accessories! Look for many new ones to be introduced in the months ahead. These accessories use the same format as APPLEWORKS files. For example, the notepad files are saved as standard word processor documents and the label printer reads a word processor document to find and print labels. PINPOINT can also be configured to reside on a hard disk (for speed), or a Ram disk (if a RamWorks or similar card is available).

Early versions of PINPOINT do not support internal modems such as the Hayes Micromodem II, but upgrades will take care of this problem. The company does support the product and has updated my disk twice at no charge! Note that this program requires an Apple IIc or ENHANCED IIe.

Adding the ability to create business graphics from APPLEWORKS data can be accomplished by stand alone graphics programs. GRAPHWORKS is one such program (albeit - one with very limited functions), that also prints the APPLEWORKS

spreadsheet sideways. Most other programs that serve these needs use DOS 3.3 and require files to be converted from ProDOS.

One of the most significant features of APPLEWORKS is the ability to easily move data in, out, and within the program. This creates an environment which invites add-on programs. Even amateur programmers can write simple custom programs which exchange data with APPLEWORKS.

FINANCIAL MANAGEMENT

The APPLEWORKS data base and spreadsheet functions may be used for a wide variety of tasks related to financial management. The development of the budget from initial planning through typing on state forms is easily within the working realm of APPLEWORKS. The process begins with an analysis of the previous year's expenditures and receipts which are contained in data base files. Next examination of tax patterns for projection purposes enhance the integrity of information to be used in creating the budget. The state aid formula is easily manipulated in a spreadsheet program to test variables such as an increasing average daily attendance, decreasing tax base, or varied levels of state funding. Salary schedules can be prepared to aid in the negotiation process and provide projections of differing settlements to aid in budgeting. Such spreadsheets help answer "what if" questions such as, "Exactly what does it mean if the base is raised $500, a step added to the masters column, and coaches are given a 4% increase? Or should the base be raised $400?".

An expenditure - income data base linked with a few BASIC programs (CHECK WRITER, BUDGET ANALYSIS, and JOURNAL REPORTER) can be used as the basis of an entire accounting package. Since APPLEWORKS data is easily sorted, manipulated, and reported, such a system gives a great deal of flexibility. For example, reporting the total amount of salaries categorized by function, across all funds can be accomplished in only a few minutes. A list sorted by vendors with otal expenditures can also be produced in a timely and accurate manner.

Salary calculations, unemployment reports, purchase order tracking, and fee collections are just a few examples of other functions with APPLEWORKS capabilities.

STUDENT RECORDS

A variety of tasks relating to student records are easily accomplished using APPLEWORKS. A student information system, with a maximum of 30 fields, contains emergency, health and directory information, birth date, bus number and pickup order, class in school and special notes. This system can generate a wide variety of reports. Phone lists, address labels, class lists, class, building and district emergency forms, and bus lists are just a few of the possibilities. APPLEWORKS' flexibility in the design of report formats, selection criteria, and output modes (hard copy, screen, ASCII file, text file, or DIF file) is one of the strengths of the program. It is also possible to generate a new data base, adding or deleting fields, from an already existing data base. Directory information can be copied to create a high school file which includes a period by period schedule, club and sport information. Later grades can be added to establish a permanent student academic record on disk.

Another student record application easily adapted to the APPLEWORKS program is a discipline file. The traditional index card file when entered into an electronic data base allows sorting by teacher, time of day, type of offense, disciplinary action, and student. This information is quite useful in the decision making - problem solving aspects of maintaining student discipline.

A popular use of spreadsheets is the electronic version of a teacher's gradebook. A blank template can be generated for teachers from the student information data base discussed earlier. With grades posted in columns and student names and scores in the rows, class and individual average, percentage, minimum and maximum scores are quickly computed. As an excellent motivational device, each student can be given a strip containing all their grades for a period of time which can be compared with the class average, maximum and minimum posted on a bulletin board.

ATHLETICS

The data base is a useful tool in scheduling athletic activities. The ability to sort in alphabetic, numeric, or chronological order allows report generation by sport, opponent, or date. In addition, the inclusion of officials, ticket takers, scorekeepers, bus drivers, etc., in the file creates a total management system for athletic contests.

Many coaches are now using spreadsheets to compute game statistics. In addition, the data base is an easy way to save school record information or handle inventory chores.

OTHER RECORD KEEPING

Equipment inventories, phone lists, personnel records, and the development of indexes for professional journals are just a few of the other data base applications utilizing APPLEWORKS. The key to development of a successful data base is to carefully define fields to allow for the efficient retrieval of information in every way which may be useful. Any record keeping task that needs to be reported in several different formats or sorted on different fields is a candidate for conversion to a data base.

WORD PROCESSING

Probably the most often used application of microcomputers in the school office is word processing. Documents which are often altered, such as board policies, student handbooks, and curriculum guides, are ideal for entry into a word processing system.

By using the word processor for newsletter articles, different margins, type styles and formats can be attempted without the necessity of re-entering information.

The development of a bank of frequently used, carefully worded letters is a time saver for both the manager and secretary. By using the Enter From Keyboard (OA-O EK) function, letters can include specific information concerning an individual without the necessity of altering the word processor document.

Although APPLEWORKS lacks the glossary ability of Applewriter II, the clipboard is a valuable tool that more than compensates. Files containing categories of frequently used paragraphs can be opened on the desktop, accessed using the file menu (OA-Q), a needed portion cut to the clipboard

(OA-C), and then copied into the original letter (OA-Q first). The process is one that proves useful in the development of special education IEPs.

As mentioned earlier, mail merge programs allow a secretary to combine a data base with a word processor file to generate a large number of personalized letters in a relatively short amount of time.

Board minutes may be entered into the word processor for future reference. By saving specific information about each motion in a data base file, it is possible to easily locate specific information in a few seconds. For example, when did the board change a specific policy or approve the purchase of new blocking sleds for the football team? By searching the data base these questions can be answered expediently and accurately.

SUMMARY

These are just a few of the possibilities for the use of APPLEWORKS in the school administrative office. Samples of the applications mentioned above are available from the author. It should be noted that invariably templates designed for use in one school setting will require alteration for use in another school.

The disadvantage of using generic programs, such as APPLEWORKS, for the tasks listed above is that the user must have a clear understanding of both the program and task at hand. Specific programs to do the same types of tasks are often available and tend to be more "user friendly". However, the advantages of increased flexibility and the ability to design applications specific to a situation may outweigh these considerations.

The ability to develop new and innovative applications of APPLEWORKS in the schools seems to be limited only by the imagination of the user. We would enjoy hearing other uses of the program. Bob Chinn, ABL School District #6, P.O. Box 62, Broadlands, IL 61816.

COMPUTERS AND PUBLICATIONS

By: John Cygan, Maine West High School, Des Plaines, IL

(The article below appeared in Scholastic Editor's Trends in Publications)

1. What PC/VDT editing system do you have?
   We have two Apple IIe personal computers with monochrome screens and printers attached.

2. Why did you select this system?
   We selected the Apple system because it is compatible with most typesetting software programs offered by yearbook publishers. Most software programs are also designed with the Apple in mind because Apple computers are so widely used in schools across the nation.

3. How long have you had it?
   We began using the computer for word processing in early 1984, and we used the Acewriter software program for a year. This year we took another step and selected the TYPESTAR software program provided by Inter-Collegiate Press which publishes our yearbook.

4. Is it a floppy disk or direct line system (modem)?
   It is a floppy disk system with an external communications modem.

5. What are the advantages of using a modem?
   The transmission of the copy is made through a phone modem. The transmitted copy is then typeset by the publishing company's computer. Two days after transmission, camera ready copy is returned to us by mail. The two advantages are a quick turn-around of copy and fewer errors in the copy, because it has been proofread by us before transmission. Thus, we save typesetting time and money in correction costs.

6. What are the advantages of using software provided by yearbook publishers?
   Using Inter-Collegiate's TYPESTAR programs makes the task of setting type quite easy. With a few simple commands we can designate copy as caption, body, headline, index, and subheads. The copy is set with column widths to accommodate the sales representative and his company. In some cases, they will even provide the computer and modem. Completing the spread will determine how well informed the sales representative is about computers, and how responsive his company will be to your needs. The students will also have an opportunity to become acquainted with the software and their feedback about the software will be important to you. In addition, because the yearbook representative will not always be there to guide you and your staff, be sure to find out if there is a company toll-free number to call and a staff to answer computer questions.

8. When is a good time to start investigating software?
   Begin looking at software packages several months before beginning a new yearbook. Once the software/publishing decision is completed, look for the computer hardware which will be compatible with the software. Run the program using the equipment just to be sure every-

thing is correct before beginning the new book.

9. What are the advantages of pastingup the yearbook copy?
After completing the trial two-page spread, you'll soon realize that you have complete control of the book's design. Adjusting layouts is easy and new copy can be written, transmitted and pastedup in a few days. One three year staff member told me, "I know we are writing, cropping, designing and pastingup, but it doesn't seem like more work. We seem to be getting things done faster and earlier." The other distinct advantage is that some companies discount production costs if the school does its own pasteup work. Thus, control is gained and costs are reduced.

10. Are students more willing to write copy if they use a computer?
Although it is difficult to measure how willing students are to write copy, they do seem to appreciate their writing when they enter it into the computer, make a print-out, transmit it and paste it up. One student, who rarely finds writing fun, insisted that other staff members watch his "stuff" get transmitted. Several days later his copy was returned and he quickly did his pasteup. He then asked several others to read his copy and said, "I did all of this, even the writing." It was obvious he had felt a sense of satisfaction.

11. Do you recommend computer usage and pasteup?
Although many of us are comfortable with the traditional approach to yearbook production, the use of the computer provides several advantages which can't be overlooked. The major advantage is the control of the book's total design. It also is faster than the traditional approach and it seems to encourage students to write more copy. In addition, using the computer carries over to other journalism activities including the school newspaper, a creative writing magazine and other student related publications. The financial advantage is the reduction of printing costs by doing your own pasteups and the reduction of correction error costs.

MAGIC SLATE--HANDS-ON EXPERIENCE

By: Ann Dana, Hinsdale School District #181, Hinsdale, IL

MAGIC SLATE by Sunburst is a word processing program that "grows with you"!! Its creative capabilities are endless. You can underline, use **BOLDFACE**, Italics, Outline, Superscript, and Subscript, all with ease. The control key, in conjunction with the other keys, does such important things as DELETE, INSERT, INDENT, CENTER, REPLACE, SEARCH, and move BLOCKS of text. The MENU has eight options and each can be quickly accessed with a move of an arrow or typing the first letter of EDIT, LOAD, PRINT, NEW, SAVE, DELETE, MAKE or QUIT.

Probably the most unique feature is the ability of the program to be used in oversize type in the 20 Column Version for the Primary Student. It is easy to read, just like a page from a Primary reading book. The regular print is the 40 Column Version. It is easy to switch from one to the other using Control C while the program is booting. The professional 80 Column Version has to have its own data disk; the 20 and 40 Column cannot share theirs. The 80 Column has even more options, but the computer does have to have an 80 Column interface card.

The manual that comes with **MAGIC SLATE** is extensive. It has booklets to duplicate for teaching or as tutorials. It lists 10 to 14 writing projects for both versions. The lessons can be used to reinforce the editing capabilities of **MAGIC SLATE.** The manual answers any question you could possibly have on how to use the program in your classroom.

You can print out in graphics or text, except in 20 column, that's just graphics. You can change margins and spacing from single to 1 1/2 to double. You can number pages, do footnotes. There's just so much to explore when you're ready. I've taken the card that lists all the commands from the manual and enlarged certain of the commands and pasted them to cards which were then laminated. These reference cards make excellent aids for the students. Each computer has a copy of the `Handbook' (part of the original manual) but the cards are easier for the students. The cards cover:

COMMAND CARD
The CONTROLs that command editing text on the screen.

CURSOR MOVE CARD
Using ESC and certain keys to move quickly around the screen.

Other formats the teachers need to understand are the making of Data Disks, which is best done with a two disk drive Apple, and printing. 20, 40 and 80 can all be printed in graphics. This double strikes for darker, slightly larger type and a must for **OUTLINE.** For the 40 column version you can control the page width by going to the Change Justification choice on the Printer Menu. This way you can stay in graphics mode and change the width by changing 070 to 075 (or other) and the margins from 015 to 005 or 010. Keep pressing return until you get it to print. Be certain you have set up the correct printer specs. This is done by CONTROL C while booting to get to the System Configuration Menu. There is a list of printers and interface cards to choose from. This is also where you change the Program Version.

Sunburst has recently published **I CAN WRITE.** It is a complete unit of 25 activities to be used at the second grade level with **MAGIC SLATE.** You make a data disk of the 25 activities for each student. They follow the instructions to put in their own names, information, words, etc. Each file masters one or more writing objectives and easily follows the language arts curriculum. When printed out, each becomes part of every students' "own book". Teachers can modify the lessons if they prefer. Students add their own art work to the print out. There are all kinds of suggestions to add to any or all of the exercises.

Sunburst is producing **BE A WRITER** for third grade with a similar format to the second grade program. They both will help to make the word processor a personal experience for youngsters. More units are being planned for 4, 5, and 6.

As these programs were not available in September, I devised another method of assisting students in gaining experience with **MAGIC SLATE.** Using their reading materials, I devised a series of lines and paragraphs at grade levels 1-6 for students to add to and edit. These were put on data disks for easy retrieval. This also helped to teach file management. As a followup, we are adding the Oral English Exercises that are used in some of our schools. These are curriculum guides developed by the Racine, Wisconsin Unified School District to help students learn to speak proper English. Monday through Thursday the students see a pair of sentences on the board. They are read and corrected orally. On Friday, there is a test of 4 sentences that covers the skills of the week--capitalizing letters at the beginnings of sentences, for proper nouns, or at the beginning of dialogue, punctuation, verb agreement, and other rules of correct grammar. With these on **MAGIC SLATE**, students can be reinforced in these skills by editing them on the screen.

Many teachers in our district took National College of Education's Writing Workshop with B. J. Wagner. The activities they developed for their classes are adaptable for use with **MAGIC SLATE.** Our schools are involved with The Young Authors Program and students are composing, editing, and creating their final manuscripts for submission on **MAGIC SLATE.** Teachers in the district share and this is where the success the students achieve lies.

Barbara Sandy, who reviewed **MAGIC SLATE** with me for Electronic Learning, uses it extensively with her primary classes. The children write group stories, dictating as Barb types. She creates fill-in-the-blank worksheets, crossword puzzles, rhyming sentences to go with her Language Arts program. The children create a weekly newspaper. Two students stay after school to write the one or two sentence stories on **MAGIC SLATE.** When the copies are made and distributed, each student adds their own illustrations. These are just some of the ways the personal involvement of youngsters can excite them and see the importance of using the computer as a tool of learning.

Besides sharing ideas, teachers can find others from reading magazines and/or books. In the February 1986 issue of Teaching and Computers, Tom Boudrot write a mystery adventure that when students follow the 8 Task Cards they gain practice in the word processing skills of file retrieval, cursor movement, deleting, editing, and creating text. It's a way of getting students involved in practicing these skills while having fun.

Another excellent resource for ideas in ways to use word processing is Michael N. Milone Jr.'s book, Every Teacher's Guide to Word Processing 101 Classroom Computer Activities for Every Grade, published by Prentice Hall. It sells for $22.95. Our Junior High Computer Lab walls are filled with Self Portraits.

The fact that **MAGIC SLATE** has three levels makes it an easy and appropriate word processing program to introduce to elementary level students and their teachers.

TEACHING AND TESTING-UTILIZING THE COMPUTER

By: Ann Dana, Hinsdale School District #181, Hinsdale, IL

Teaching materials that can be computer generated to our own specifications should help to make the work load easier. More and more publishers are adding software to their textbook series. Some of these can easily generate materials for use with our classes. The following is a list of software that can be classified as utilities. Some are excellent and do help us easily and also help the students learn in perhaps an alternate way that could be motivating. Several of the programs are passé or were so well advertised we were convinced they were a necessity.

TEACHER UTILITY SOFTWARE

1. ALL OF THE ABOVE - C & C SOFTWARE
   5713 Kentford Circle
   Wichita, KS 67220
   $75.00 (4 data disks $40.00)

   Create a test. Need 2 drives to create and get manager, but only 1 drive to take test. Great for unit tests and combining these to make a semester test. Will randomize to your specifications. Can use a variety of questions. True/False, Short Answer, Multiple Choice (with or without feedback), Matching.

2. COMPUTER GENERATED MATH VOL. 1 & VOL. 2 - MECC

   Generates math problems for worksheets by objective numbers. These take a while to create, but matching a need to an objective is important.

3. CREATE WITH GARFIELD - DLM Educational Software

   Be a cartoonist and design your own comics. Make single sheet or a series of small ones to complete your own strip. Makes labels, posters or cartoons. This type of utility is a motivator, not a necessity, but fun for the students.

4. CROSSWORD MAGIC - MINDSCAPE

   Exceptional crossword puzzle. You enter words and definitions. Can be saved on disk. This is a nifty way to get kids to learn the vocabulary of units they're studying. Let them make the crossword puzzles.

5. ENGLISH VOL. 1 - MECC

   Generates an English grammar test. This appears to be one of the very few in the language arts area. It works with parts of speech and you can choose which one, or ones, need to be tested.

6. GREETING CARD - COMPUTER SKILL BUILDERS

   Example of the very poorest of programs. Try it to see. We beginning programmers could do better. (I fell for that ad!!)

7. LAND of PROMISE, A HISTORY of the UNITED STATES to 1877 TEST GENERATOR - SCOTT, FORESMAN

40 questions for each of the 18 chapters. Tests, map, chart, and graph skills, chronology skills, and critical thinking. Each set of chapter questions has a black line master of a map and/or chart to accompany the test. Although this generator accompanies Scott Foresman's text, by checking the questions, you know you could use it with other social studies texts. The manual lists every question. Teachers can add their own. Alternate forms can be printed out. Answer key is also printed.

8. MATH WORKSHEET/TEST GENERATOR - Ray Hassler - HINSDALE DATA
P.O. Box 251
Hinsdale, IL 60521-0215

4 disks with which you can create math worksheets from Basic Skills to simultaneous equations in Algebra. Choose up to 30 problems. Worksheet has a foldover column with the answers. Bend it over and reproduce the rest for a quickly created math review sheet or test.

9. MICROZINE - SCHOLASTIC, INC.

This popular software magazine on disk has several utility programs that teachers and students can use.

#12 - "Newspaper Maker" - not anywhere as good as NEWSROOM, but if that's what is available the experience is worthwhile.

#14 - "Cartoon Maker" - has over 50 graphics to choose from plus word balloons to fill with funny text.

"The Puzzler" - create a crossword puzzle for any subject area, but it no way comes up to Mindscape's, CROSSWORD MAGIC.

10. THE NEWSROOM - SPRINGBOARD

With practice you can make your own 2 column newspaper without cutting and pasting. It has a companion graphics disk. There is also a version by Scholastic that includes additional ways of using NEWSROOM within a variety of academic areas; such as a science newspaper on rocketry, a history newspaper with reports on early Greek history, individual creative writing worksheets. It gives excellent ideas on how to introduce the various parts of NEWSROOM to the students.

11. PFS - PERSONAL FILING SYSTEM - SOFTWARE PUBLISHING CO.

Create a data base - print out the fields for student research. They can fill in the information on the computer and later do a search of similarities.

Create a data base for keeping track of resource material by subject.

Use a data base in the library to keep track of overdue books.
(Just a few of many, many ways to incorporate data bases in your teaching.)

12. PRINT SHOP - BRODERBUND

Exceptional program, makes cards, banners, posters, letterheads. Very user friendly. It has additional disks, Companion for other borders and fonts, 3 with other graphics, and Graphics Extender. There's no end to what you can create or combine with other materials to liven them up.

13. THE PROFESSIONAL SIGN MAKER - SUNBURST

Has 12 unusual borders and a whole cast of special characters that you can easily get with CONTROL P and a keyboard character.

14. PUZZLES AND POSTERS - MECC

Revised from Teacher Utility Vol. 1. Makes good crossword puzzles. Posters aren't up to Print Shop.

15. SCHOOL MAGIC - McCARTHY-McCORMACK, INC.
1440 Oak Hills Drive
Colorado Springs, CO 80919
$49.95

A very user friendly utility for the elementary teacher. It has the basic forms for certificates, book marks, field trip permission slips, note paper, invitations. Each and every one can be personalized or fill in all the information but leave a blank for the name. You can make rewards or invitations to plays, PTO events, etc. Use their pictures or fill in the blanks with the words and let the students illustrate. Example subject logos are sports, computer, fantasy (a unicorn), reading, math, etc.

16. SCIENCE SQUARE OFF - SCOTT, FORESMAN

A Tic Tac Toe Game of the screen or a test generator for the teacher. Either one lets the teacher choose the questions - recall, comprehension, or extension. Alternate forms of the test can be printed. An answer key is printed after each test form. The disks accompany Scott, Foresman's Science Series. Attached you will find sample tests for Grade 5 and Junior High Level Life Science. The questions could match information in other science series.

17. STUDY GUIDE - MECC

Create a test with a variety of questions, but it needs 2 disk drives to create and take.

18. TEACHER UTILITY VOL. 1 - MECC

Banners and posters only, don't use this crossword.

19. WORD SEARCH - MECC SPELLING MASTER OR ELEMENTARY VOL. 2

A word search can be created using words saved on disk, nice way of reinforcing the spelling for the week.

20. WORD SEARCH - PUBLIC DOMAIN*

This program has a SIZE program to let you print out a word search in large type with an Epson Printer. Cannot save words on the disk; must enter each time used.
*may copy

21. WORKSHEET GENERATOR - SRA

Create math worksheets to complement the computer software. You choose the types of problems the student is having trouble with and create a special worksheet.

This list is probably but a handful of what is available. The computer is a tool to give help to the teacher in as many areas as possible. It is a tool to make learning easier, more enjoyable and more extensive. A word processor is probably the most valuable use of the computer, at least for those of us whose typing skills are not proficient, as well as storing all our files. The use of data bases for inventory and manipulation of data and sources of information are invaluable. Spreadsheets or grade book programs help our accountability. Worksheet generators are the everyday kinds of help we look for. But to take the mundane out of the day work with Print Shop or Garfield or The Newsroom. They excite the kids and maybe will turn us on too!

INSTRUCTIONAL GAMING - EQUATIONS

By: Stuart L. Danzinger, Community Consolidated School District 59, Arlington Heights, IL

A knowledge of mathematics is essential to all people trying to function successfully in today's ever expanding technology based society. It comes as no surprise that curricula and methodologies in the area of mathematics are constantly adapting to keep pace with the technological advances. The introduction of the microcomputer to schools has opened the door to exploring the mathematics of the future. And yet, the bottom line in mathematics education has not changed and perhaps never will. Students of mathematics still need to learn the **basic** skills. How these skills are presented and taught may vary as educational technology changes, but students need to learn these skills in order to succeed in today's society.

The goal of the mathematics instructor is to find the most effective way to teach the **basic** skills. Many methods have been tried and many of these methods have proved successful, however, special attention must be given to the audience with which we are working. The students we are working with today are in many ways similar to the students that have been taking mathematics courses for centuries. Most students come into a mathematics course ready to learn, but some become alienated to the concepts educators are trying to teach. Research has been conducted to try to determine why some learners simply turn off to the subject of mathematics. Everything from students to teachers to materials have come under examination. The result of this research is often inconclusive, but gives us many avenues to pursue. One of these avenues is in the area of instructional gaming. The premise of instructional gaming is based on the principle that children learn things more easily when they are motivated and are enjoying what they are doing. This premise can be applied to all areas of instruction, including mathematics.

Dr. Layman E. Allen, from the University of Michigan, has developed this premise and created the game of creative mathematics, **EQUATIONS.** Unlike many games used in the mathematics classroom, **EQUATIONS** is a game that challenges, motivates, and grows with the student. It has been used successfully with mathematics students from second grade through college. **EQUATIONS** was originally piloted in the inner-city Detroit public school system. The students from this area that scored well below average on national achievement tests, had extremely negative attitudes about themselves and school, and had very high absenteeism rates.

Research conducted during the pilot of the **EQUATIONS** Instructional Gaming program showed some surprising results. Students that were taught and used the game of **EQUATIONS** showed significant increases in their mathematics achievement, as measured by the Stanford Achievement Test in Mathematics. Absenteeism among the students using **EQUATIONS** dropped dramatically. Attitudes about self, mathematics, and school increased significantly in the groups using **EQUATIONS.** Yet most significant was the fact that these students showed tremendous increases in their non-verbal I.Q. scores, as measured by the California Test of Mental Maturity. In some cases students doubled or even tripled their non-verbal I.Q. scores. These results have been repeated during almost two decades of research and testing using problem solving games as a basis for the mathematics curricula.

Having used the **EQUATIONS** program in my mathematics classroom for over five years, I can support these findings. One particular instance can be used to demonstrate the effect of the **EQUATIONS** program. In my seventh grade pre-algebra class, I had a boy that loved to play **EQUATIONS**. He drove himself to learn every aspect of the game. I was hard pressed to keep one step ahead of him. In sixth grade this boy had taken the Illinois Math League Test and his score was not one of the top five scores in our school. The only significant change in his mathematics instruction in seventh grade was the inclusion of the **EQUATIONS** program. By March of his seventh grade year, having had about seven months of **EQUATIONS** experience, he took the seventh grade Illinois Math League Test. Not only did he have the highest score in our building, but he had the top score in the State of Illinois. Though this example is not typical, it demonstrates the positive effect of the **EQUATIONS** program on student achievement.

The basic components of the **EQUATIONS** Instructional Gaming Program are the game, the classroom tournament structure, the organization of the class into teams, and the supplemental teaching materials. The **EQUATIONS** game is a problem generating/problem solving activity. Students are given a group of numeric and operational resources and are asked to build equations in a very open-ended manner. The complexity of equations formed are limited only by the students' knowledge. The more the students know, the better at the game they become. Therefore, the instructor often finds himself in the unique situation where students are demanding extra instruction so they can be more successful in playing the game. It would not be unusual to see sixth grade students involved in the **EQUATIONS** program to be formulating equations using negative fractional roots.

When using the **EQUATIONS** program, it is necessary to establish a classroom tournament structure. The **EQUATIONS** tournament occurs once a week during a single math period. The class is divided into game-playing groups composed of three students of approximately equal math ability. The students in each group play several rounds of the game with each other during the period. After each week's session, the high scorer in each playing group graduates to a group with more difficult competition. The low scorer joins a group with easier competition. This "bumping" procedure continually equalizes the competition and compensates for differential learning rates. It insures that experiences of "winning" and "learning" become equally distributed among all tournament participants.

The third component of the **EQUATIONS** program is the organization of the class into teams. The typical classroom is divided into six teams. The teams are selected by the students through an organized selection process. This adds another dimension to the **EQUATIONS** program. Students are not only playing for themselves, but are representing their team in each weekly tournament. At the end of each month, teams are awarded points based on their finish that month. At the end of the school year the team points are totaled and as a cumulative activity an **EQUATIONS** World Series is conducted. During the course of the year students develop a team identity. Because the teams are selected heterogeneously, an unusual phenomenon takes place. Students on the same team band together and the more skillful players work with the less skillful players to improve their game playing skills. In **EQUATIONS** this phenomenon is referred to as team teaching. Peer relationships improve and the atmosphere in the classroom becomes much more positive.

The final component of the **EQUATIONS** program is the supplemental materials available to the students and instructor. One could argue that this program is successful without extra materials and this premise would be correct. But Dr. Allen was not about to let his program remain static. The advancing technology and decreasing cost of computerized instruction inspired the recent development of the **DIG** (Diagnostic Instructional Gaming) Math computer program. The **DIG** Math Program was designed as an interactive reference and self-teaching guide to enrich the classroom use of **EQUATIONS**. It provides diagnosis and individualized tutoring for a broad range of mathematical concepts. Each unit in the **DIG** Math Program begins with a series of diagnostic exercises to assess the user's understanding of several related math concepts. Based on the user's performance, the computer then prescribes a series of **EQUATIONS** matches for the user to play against the computer. During each match, the computer makes moves that lead the user to discover and apply a specific math concept. The computer is not programmed to try to win a match, but rather creates situations in which the user can win if he or she sees how to apply the appropriate math concept. This program is excellent for helping instructors improve their problem solving skills as well as for providing individualized instruction for all their mathematics students.

Another supplementary program available on the computer is the **EQUATIONS** Challenge Matches program. In this program the computer manages a series of matches between two players or teams. The computer acts as guide, gameboard, referee, scorer, coach, and tutor. As a match is played, the computer keeps track of the mathematical ideas encountered by the players. The computer then arranges future variations of the match that will lead players to discovered, unexplored ideas. The Challenge Matches program preserves the spontaneity of live competition, while at the same time guides players toward a deeper appreciation of the game's more subtle possibilities.

In conclusion, it can be said that instructional gaming is an effective method of teaching students basic skills. The total **EQUATIONS** program, however, is much more than a delivery system. It is a comprehensive package that teaches, motivates, and challenges students to use critical thinking and problem solving skills to reach their full potential in the area of mathematics.

THE COMPUTER AND PROCESS EDUCATION

By: Andrew David, Chicago, IL

At the inner city school on Chicago's West Side, a year-long project is being implemented to integrate word processing into the writing curriculum. The project utilizes the school's computer lab (with 1 full-time coordinator, 30 Commodore 64 computers, 4 disk drives with switching banks, and 2 printers) and serves approximately 150 students in five classrooms with five classroom teachers. The consultant package includes regular in-class writing workshops and support for the computer lab coordinator. The students visit the lab in groups of 30 once a week for 35 minutes. Bank Street Writer is the software used.

The teachers, who have been somewhat hesitant to get involved in the computer component of the project, have finally begun to receive paper printouts after their students return from the lab. If they were to judge from these results, they might well conclude that word processing has not improved their children's writing. Typically, the majority of the students' writing have regressed as they struggle with new phenomena-like menu selection, cursor movement for editing, keeping track of disk files, and navigating the keyboard. But there are other ways to explore issues of success or failure in this situation: Has their classroom (pen-on-paper) writing improved? Are they more motivated towards writing? Are they excited about their visits to the lab? Are their teachers taking more or different kinds of interest in what the students do? If the answer to any of these questions is "yes" then what is happening? If the computer is not directly improving their writing skills, what is it providing?

Increased involvement, motivation, productivity, or excitement follows from a series of successful moments for the child, even if the successes are not entirely visible or clearly related to curriculum objectives. Process Education, as referred to here, is not a formal approach or methodology. It simply presumes that the child's moment of interaction (with the computer in this case) is the subject matter to be explored, and that the teacher can be most effective when he or she is sensitive to the moment. Any time a teacher spontaneously - often intuitively - deviates from the lesson plan to meet a recognized need, a kind of Process Education is taking place. Since such times tend to be emotionally involving, it is often difficult to sort out what has happened in such a way that daily, weekly, or yearly plans can be organized around them. It has been my experience that a certain amount of self-consciousness about the Process Education already inherent in our teaching can help us to identify important moments of discovery for the child.

The potential of the much-touted personal computer is real. In practice, its application is often unclear. The remainder of this paper focuses on a few of the things that have consistently affected and shaped the experiences I have had with children, teachers, and computers. This breakdown is offered as a possible starting point for the sorting out of individual personal experiences.

The Tug and Pull of the Moment

When the child sits down at the computer, several things "compete" for the moment. Physical environment is an important factor, one which I will not focus on here except to say that the popular configuration of a "computer lab"

seems to present the computer as something-to-do rather than as a resource in some larger classroom project. Three other things, always present, combine to shape the moment: the child's personal agenda, the design of the computer and its software, and the teacher's influence.

The Child's Personal Agenda

Putting yourself in the place of the child, questions like these may come up regarding a visit to the computer.

- What's expected of me? (by my teacher? by the computer?)

Some children attribute a will to the computer such that it appears to be expecting something. Some software leads easily to a personification of the machine.

- What is this computer all about?

- What would I rather be doing?

- Why do I have to come to this computer?

- What can it do for me?

- What will happen if I push this key?

Again, these are but a few items on the list. The child's perception of the computer, its importance, and his or her reasons for using it, provide the primary framework for the moment and the decisions or actions that will result.

The Design of the Computer and Its Software

Although software has been developed for applications in the curriculum, it introduces new elements that may dominate the child's experience. When a first-time user boots up Bank Street Writer, then presses the "j" key until the screen is filled with "js", is this a waste of time? Before deciding, imagine what it must feel like the first time to push one button and create TV, with a little box that spins across the screen leaving letters in its path. This may not be sufficient to make such an activity worthy of class time, but it may help to distinguish between discovery of writing and discovery of the computer.

Some software will not even allow this. Each case of software design anticipates the experience of the child and, in so doing, partially shapes it.

Two clarifying questions are pertinent here:

- At what point does (must) the child digress from the primary activity in order to explore the computer or software design?

- What are the assumptions of the software designers?

The Teacher's Influence

The teacher's relationship to the child/computer/moment is always a factor, even if the teacher is not present. Influence on the moment can be divided into four areas: (a) preparation, (b) sensitive observation, (c) intervention

or redirection, and (d) processing or evaluation.

Preparing the moment includes setting a context and a reason for going to the computer. How much emphasis is on the machine? How much is on the problem? Is there a problem? Are they going there to produce or to create? Are they going with goals, methods, or both? What preceded their visit and what will follow?

Becoming sensitive to the moment can be difficult if you are experiencing too many competing demands. The ones you can control are those internal expectations or beliefs that might dominate perceptions of what is taking place. By (a) suspending judgment, and (b) adopting the child's point of view, you can put aside what you know and create a fresh outlook and an open stance.

Intervention is never at random. What triggered it? Will you ask an open question like "What are you doing?" to focus the child or a leading question like, "Can you make that even bigger?" which clearly redirects the work. Will you take over the process and do some of the work yourself (like writing a help procedure in Logo) or impose limitations that will channel the child's energy. Do the limitations, in fact, channel or do they stifle the energy?

Everyone processes in their own way. Here are four questions to reflect on your relationship to what happened: (a) Is it what I expected? (b) What happened instead? (c) Is that as important? (d) What criteria am I using to decide?

Underlying all of this are the teacher's personal agenda (I want to love every child today; I want them to have a chance to apply their power, etc.) and curriculum objectives (raising average reading test scores, etc.). When these two are in agreement, the teacher can be very powerful. When they are at cross purposes, effectiveness is undermined.

An Exercise in Feedback

This is intended for groups of teachers though a single pair could try it. Members of the group should pair off. The first in each pair selects a favorite moment with a child at the computer. Any moment will do, as long as it stands out vividly. This story will be told as personally and with as much detail as possible. The second in each pair will listen with feedback criteria agreed upon by all the listeners, like "How does she/he regard the computer?"; "How does she/he regard the child?"; "What is his or her personal agenda here?"; and so on. The feedback person is supposed to listen with an ear towards sorting out the assumptions and attitudes the storyteller brought to the moment and how it affected what took place. To prevent self-consciousness, the story-teller is not informed what the listener's feedback criteria are or, if possible, even that there are any criteria. After story-telling and feedback, pairs can share their discoveries with each other.

This kind of activity, of course, need not be confined to an exercise. What makes it effective is the conciseness of the criteria.

If it is true that teacher influence, computer and software design, and the child's personal agenda compete for the moment of learning, the best strategy would be to create a win-win-win methodology so that they are all in alignment. A closer look at the interdynamics of these three in our own

settings will sharpen the picture. We can imagine ideal learning environments and miracle technologies of the future, but we are not likely to get there until we have become more intentional about our current situations. The more I visit schools, the more I believe that we have no business predicting the future until we have clarified the present.

FREDWRITER: AN APPLE II PUBLIC DOMAIN WORD PROCESSOR

By: June Dodge, Coordinator TECC-15/CIC Summer Writing Project, San Diego, CA

FrEdWriter is a public domain word processing program for the Apple II series. The program gives all owners of the Apple II computer the opportunity to have their students use word processing to enhance writing skills. There are four main reasons why teachers should adopt the word processor for use with their students: it is free; it is easy to start using; it has features to grow into; and, it is supported by the educational community.

FREE

The program was originally written by Paul Lutus. Paul is the author of the famous Applewriter word processing program. While working on a new version of Applewriter, he grew tired of the project and donated the incomplete code to the public domain. This program was called "FreeWriter".

Al Rogers, computer specialist at the San Diego Teacher Education Computer Center acquired a copy of the code. Al decided to complete the programming, and to make the program easy enough for students to use. He made extensive changes to the program and changed the program's name to "FrEdWriter" or Free Educational Writer.

Recently, this program was donated to the public domain. That means you can legally make copies of the program for use in your classroom or your home.

EASY TO START USING

The program is relatively easy to start using. You need to have a properly equipped Apple and you need to know how to load a program.

This program will work with an Apple IIe or with an Apple II+ with a lower case chip and at least 64K of memory. FrEd will take advantage of two disk drives, but you only need one. In order to print documents you will need to have a printer.

Once you have the proper machine you simply insert the disk and turn the power on. You will be presented with a main menu. The first time you use the program you will want to select **#1 - Read this First.** This section will give you all the directions for printing out the documentation for the program.

When you are ready to start using the program, you will select **#2 - Start FrEdWriter.** Once you press the RETURN key three times you will be in the editing mode. In this mode you can press the CONTROL-T to see a list of the commands used with the program.

All you need to start using the program is to know how to load the program, how to move the cursor key, how to insert and how to delete. On the IIe you use the four direction arrows to move the cursor. The II+ uses the right and left arrow keys and CONTROL-A to move up one line, and the CONTROL-Z to move down one line. To insert text you use the cursor moves to place the cursor on the spot where you want the text to appear and you start typing. To delete with FrEd you move the cursor one space beyond where you want to delete and you press the DELETE key (on the II+ you press CONTROL-D). Each time you tap the key a letter will be erased.

FEATURES TO GROW INTO

Once you start entering text you will want to save the file or print the file out. The commands to do those functions are easy to remember: CONTROL S and typing a name will save the file. CONTROL-P will print the file. Once the file is saved you may want to call it up again later. The command to load a file is CONTROL-L. If you can't remember the name of the file, of if you want to use the second disk drive, you would enter the question mark symbol. Question Mark comma D2 (?,D2) will give you a listing of files found on the disk in drive two.

Once you are comfortable with using FrEd as a computerized typewriter, you can grow into the other features that are available: moving blocks of text, copying text, find, find and replace, centering, changing format, renaming files, deleting files, formatting data disks, making copies of the files, etc. Information for executing all these features is explained in the documentation.

Prompted Writing

In addition to the features found on most word processors, FrEd has a unique feature which we call **prompted writing.** With this feature the teacher can write guides to writing so the student can write a paper that ends up being very sophisticated. The teacher composes these guides in protected areas. When the student prints out the file, the prompts are not printed, so the student gets a paper that is organized.

The Writing Process

Prompted writing encourages students (and teachers) to incorporate the writing process into their writing. The student uses the prompts to guide them through the pre-writing stage. Once they have written the first draft, they delete the prompts and start working on the composing and further drafting of their paper. Students print out copies of their paper and get feedback from other students, revise based on that feedback, and then edit their final version.

SUPPORTED

Teachers can get model lessons made with FrEdWriter. Last summer the Teacher Education Computer Center and the Curriculum Implementation Center (both in San Diego, CA) paid for 10 teachers to learn the program and write lessons incorporating FrEd into their classrooms. These lessons each have sections on: word processing, writing, literature and the California Model Curriculum Standards for language arts.

The lessons prepared during this project are targeted for different classroom situations (computer lab, to 1 computer per class) and different grade levels.

Users of FrEdWriter who write lessons or prompted files that they would like to contribute to the CUE Softswap Project should send their disk files and release form to: Bruce Fluery, Softswap Chair, 3225 Petunia, San Diego, CA 92117.

HOW TO OBTAIN THE FREDWRITER PROGRAM AND LESSONS

They will be available from CUE Softswap through the San Mateo County Office of Education. For ordering information send $1.00 to:

CUE Softswap Project
SMERC Library
San Mateo County Office of Education
333 Main Street
Redwood City, CA 94063

FREDWRITER MODEL LESSON ABSTRACTS

1. LESSON ABSTRACT

LITERATURE: Charlotte's Web - Children's Fantasy

GRADE LEVEL: 4th grade

ENVIRONMENT: Classroom with access to computer

TIME: One month lesson

SUMMARY: This lesson guides the teacher through every stage of the writing process. Reading log prompts have been written for student use during the reading of the classroom favorite, Charlotte's Web. Students cluster, model, word process, respond, revise and edit. The prompts have been successfully used by the 3 pilot classes.

TEACHER - AUTHORS: Debbie Atkerson - Patty Fares
San Diego City Schools
San DIego, California

2. LESSON ABSTRACT

LITERATURE: Pecos Bill - Tall Tales

GRADE: 4-6 - Adaptable for younger with more teacher directed activities.

ENVIRONMENT: One computer for class of 30-35 students.

TIME: Reading 8 days x 30 minutes; Writing 2 weeks, if scheduled all day.

SUMMARY: Teacher reads the story out loud with discussions, activities follow each reading. The reading log is utilized as a way of responding, summarizing, predicting, etc.

Prompted writing is used as pairs of students create a super hero of their own. They follow the writing process to create a publishable tall tale. Many offline activities are provided.

TEACHER - AUTHOR: Linda Chick
Lake San Marcos Schools
San Diego, California

3. LESSON ABSTRACT

LITERATURE: Adventures of Ulysses - Setting and author's purpose

GRADE: 7 (Very adaptable!)

TIME: 2 weeks

ENVIRONMENT: One week in regular class; one week in computer lab

SUMMARY: This lesson depends on the publishers' teachers resource book for reading, vocabulary lessons, and class discussions. The English teacher and the computer resource teacher collaborate so students learn about setting and author's purpose. Students are guided with a lesson prompt to write a descriptive paragraph about how mood and setting are intertwined.

TEACHER - AUTHOR: Carolyn Curtice, Sweetwater Schools, San Diego, California

4. LESSON ABSTRACT

LITERATURE: Mouse and the Motorcycle - Beverly Cleary

GRADE: Fourth

TIME: 2-4 weeks

ENVIRONMENT: Two students at computer

SUMMARY: Adaptable lesson that includes all the details needed by a beginning teacher. Procedures are written in an easy reading format. The classroom management indicates in-depth, realistic planning. Students learn sequencing and summarizing skills, plot development and the writing process. The class joins together in writing a book review of the book.

TEACHER - AUTHOR: Jan Garbosky, San Diego City Schools, San Diego, California

5. LESSON ABSTRACT

LITERATURE: Witch of Blackbird Pond

GRADE: 6-8 TIME: 7 Weeks

ENVIRONMENT: 1 computer and 1 printer - Lesson planned for small reading group (replacing basal reader).

SUMMARY: This lesson culminates with students writing a position paper on character and character traits. Teachers are given hints on organizing class time to include computer word processing in the reading classroom. Golden line editing, vocabulary development, and comparison paragraphs are presented using FrEd. Independent and teacher directed activities are included.

TEACHER - AUTHOR: Chris Evans, Poway Schools, San Diego, California

6. LESSON ABSTRACT

LITERATURE: Charles - Shirley Jackson - Short Story

GRADE: Secondary (high school) TIME: Varies with end product desired

SUMMARY: This short story is the jumping off point for students to learn about point of view and characterization. Students are guided through prompted activities to write about themselves from three different perspectives: themselves, a parent, or a friend. They practice specific skills within the context of the writing activities. The lesson starts with students learning about each other and ends with each student knowing himself more completely.

TEACHER - AUTHOR: Sharilyn McSwan, San Diego City Schools, San Diego, CA

7. LESSON ABSTRACT

LITERATURE: Season Songs - Ted Hughes - Haiku and Diamente Poetry

GRADE: 6-8

TIME: 3 weeks x 50 minutes. 2 days at computer lab or 1 week if scheduled in classroom.

ENVIRONMENT: 15 computers

SUMMARY: Students are presented with one form of poetry, and led through a guided reaction and interpretation. They apply the new knowledge by writing their own poems. The lessons give students practice in writing Haiku and Diamente poetry. Reading logs are used to record opinions, ideas, thoughts, and answers to reading questions. Prompted writing assists students in composing their poems.

TEACHER - AUTHOR: Barbara Miller-Souviney, Vista Schools, TECC-15, San Diego

8. LESSON ABSTRACT

LITERATURE: Sea Devil - Arthur Gordon

GRADE: 8 - but can be adapted to lower or higher levels.

TIME: Four days in lab

ENVIRONMENT: 18 Apples, students work in pairs.

SUMMARY: Pre-reading and pre-writing activities are used to motivate students to read, help them understand when they read, and help develop fluency in writing. Writing activity called modeling or copy-change (an activity where students imitate a paragraph in their reading by supplying their own content to the syntax of the original). The exercise helps them stretch their ability to use new words. It encourages them to understand how authors accomplish sentence variety and gives them practice in writing in a new way.

TEACHER - AUTHOR: Mary Ann Wheeler, Sweetwater Schools, San Diego, CA

VIDEO INSTRUCTIONAL SYSTEMS FOR MICROCOMPUTER CLASSROOMS

By: Brian E. Engel, PC Learning Systems, Inc., Milwaukee, WI

INTRODUCTION

The use of the microcomputer in the classroom has resulted in unique instructional challenges. The instructor must be able to effectively demonstrate course material to the entire class. The students' work must be monitored to evaluate their progress. The class as a whole should benefit from the efforts of the individual student. Educators have been striving to find a method of accomplishing these instructional goals.

THE FIRST APPROACH

The first attempts at finding a solution to the instructional challenges found in the microcomputer classroom were based upon the sharing of information through a data link. The use of data networks in the microcomputer classroom allowed software to be downloaded to each CPU. This saved the expense for multiple disk drives and software copies; however, it created a new concern over copyright protection.

An improvement over the data network is a Local Area Network (LAN). A LAN allows two way communication between the students CPU and the main storage system's files and software. With the appropriate software package, a LAN can be operated as a classroom management system. Effective operation and maintenance of these systems requires someone with extensive computer knowledge and experience. Both a data network and a LAN allow for transfer of information; however, they do not address the concerns of instructors.

AN ALTERNATE APPROACH

Rather than turning to data transmission to address this challenge, a second school of thought worked to improve the instructional presentation. When computers were first introduced into the classroom, no method was available for the instructor to demonstrate courseware to the entire classroom. The students gathered around one small monitor at the instructor's desk to view a demonstration and then the instructor would have to review the material with each student individually at their workstation to reinforce the learning process.

An advancement over the small monitor was to connect the instructor's computer to one of the new video products being introduced on the market, a large monitor or video projector. The large monitor allowed the instructor to display an image so that the entire classroom could easily view the demonstration. This was acceptable for 40 character text and graphics images where small detail was not a concern. When displaying images other than graphics, such as 80 character text, the image was unreadable when viewed from a distance greater than ten feet. This required two or more monitors to be placed around the room to allow the students to have a clear view of the material. When using a video projector, the difficulty lies in the ability to see the projected image against background lighting. As with a movie screen, unless the lights in the room are turned off or turned down very low, it is very difficult to see the image on the screen. Another concern when projecting the image onto a flat surface, such as a movie screen, is one of image quality. Projector manufacturers recommend the use of concave screens to obtain the best-results. The difficulty with a flat surface is that the corners of the screen are not the same distance from the lens as the center of

the screen, the focal point. The images at the corners of the screen may become blurred, making them unreadable.

THE DEVELOPMENT OF VIDEO INSTRUCTIONAL SYSTEMS

Rather than using a large monitor to demonstrate material to the class, an educator from the University of Wisconsin, Prof. James McNeary, experimented with the concept of placing the demonstration material directly on the students' monitor. What evolved over the years was the first video instructional system called IVAN.

A Video Instructional System (VIS) allows information in the form of a video image to be shared throughout the classroom. The instructor may send either the instructor's or a student's screen to all of the students or to a selected group of students with the touch of a button. This places the instructor's demonstration on the most visible screen, the one right in front of the student.

CONTROL OF THE CLASSROOM IS IN THE HANDS OF THE INSTRUCTOR, NOT THE STUDENTS.

With the ability to send an image to the students' monitor, the instructor has effectively taken control of the student computer and captured the students' attention for the demonstration or lecture. The instructor controls what the student views, whether it is the student's own work, the instructor's presentation, an example from another student, a video tape presentation, or even a blank screen. Any video signal, whether from a computer, a video tape, or video disc player, can be shared throughout the classroom.

THE INSTRUCTOR HAS MORE TIME AVAILABLE FOR TEACHING

Using a VIS, the instructor with the touch of one button can review any of the students' work. Rather than moving about the classroom, the receive feature allows the student's screen to be placed on the instructor's monitor. While this does not completely replace the one-on-one contact with students, it does allow the instructor to do a quick check on each student without interrupting the class or an individual student. The students learn more when they are not interrupted. The student requiring assistance can be pinpointed and immediate help can be given by using either the VIS send feature or personal one-on-one instruction.

THE INSTRUCTOR CAN INCREASE THE INTERACTION AMONG STUDENTS

Using the receive and send features, the instructor can share student work with the rest of the class. Another option is the "Chalkboard Effect", having the students place their homework problems on their computer then sharing screens around the room.

COURSEWARE INSTRUCTION IMPROVES

Before the advent of the VIS, courseware was demonstrated to the students all at one time, allowing the students to visualize how the material is to be used. Then the instructor would move around the classroom working with each student to familiarize them with the material. Using the send and receive capabilities of a VIS, the instructor can alternately demonstrate a new concept and monitor student response. This provides an entirely new approach to instruction of computer courseware, allowing material to be broken into

logical segments of demonstration and exercise.

THE LATEST IN TECHNOLOGY

On the surface, a VIS appears to be a fairly simple concept. Video switching has been second nature in the television industry for some time. The first developments in video instructional systems (including IVAN) used the same basic television switching technology, linking all monitors back to a central switching panel. A cable was connected between each computer station and the control panel. The instructor would manipulate a series of switches to transmit the signal throughout the classroom. However, these original systems developed serious reliability problems related to the switching device. Just as with a mechanical tuner in a TV set, the contacts experienced wear and the switching device eventually malfunctioned.

The most advanced VIS designs make use of state-of-the-art electronic switching; just as in the television, mechanical contacts have been replaced with electronic circuits. In addition, the IVAN system makes use of the latest microprocessor technology to analyze the command requests and perform the appropriate switching. Even more important, the microprocessor's digitized command signal allows the bulk of the individual computer cables to be replaced by a single cable routed throughout the classroom. This saves valuable installation time, eases the problem of cable clutter, and virtually eliminates the difficulties of trouble shooting the system in the event of a malfunction.

SUMMARY

Video instructional systems enable computer instructors to become more effective educators. The systems provide the instructor with fingertip control of the classroom for monitoring and demonstration purposes without moving from the teaching station. More classroom time can be devoted to extending the teacher's expertise to each student. The ultimate goal of the computer in the classroom is to improve education, and a VIS is a vital part of that instructional challenge.

COMPUTER USE IN PHYSICAL EDUCATION

By: Ron Freeman, Forest View High School, Arlington Heights, IL

The purpose of the Forest View High School physical education program, which is a physiological approach to physical education, is to change the major emphasis of physical education from that of teaching mostly leisure-time activities and sports to the teaching of physiological concepts and health-related fitness.

A major goal of physical education has been to teach students games and sports that could be utilized as leisure-time activities. Students are supposed to gain knowledge about how to play various games and sports. They are supposed to develop adequate skills that will enable them to play the sport. They are exposed to many different games and sports so that they can develop interests and choose a lifetime activity.

The development of physical fitness is considered to be a result of being involved in physical activities. Because of this kind of approach to physical education, the physical fitness needs of students are not being met. The teaching of leisure-time games and sports, physical skills, life-time activities, and physical fitness is very important and must be taught; however, the major emphasis of physical education should not be only the teaching of skills or how to select a lifetime sport. Physical education should place its major emphasis on why exercise and fitness are important, what one's own fitness needs are, and how to attain and maintain fitness throughout one's life. Rather than physical fitness becoming a resultant of participating in leisure-time games and activities, it should become the major focus of the curriculum.

Our nation, in recent years, has become very health and fitness conscious. Most Americans believe that participation in some kind of regular physical activity is important. Many people are now realizing the value of being active and feeling physically fit no matter what their age. Many studies have shown that physical fitness declines with age; and, even though people believe physical fitness is important, fifty percent of all teenagers cannot pass a standard physical fitness test. It is very important that physical educators teach physiological concepts, or why physical education is important, what one's own physiological fitness needs are, and how to attain physical fitness and maintain health and fitness throughout life.

Typically, students are placed into physical education classes according to their year in school during any available class period. Physical fitness, even though it is considered a major objective of physical education, becomes a by-product of the activity being taught. The students in the class are a heterogeneous group of people, all having different physiological needs. Some of these students will be in excellent physical condition, some will be average, and some will be in very poor physical condition. The attitudes that are developed by students in these kinds of classes are generally negative toward physical education, and positive achievement is experienced by only a few. Using a physiological approach to physical education allows for positive outcomes to be measured for each student in all classes. This new approach also teaches skills for leisure-time games and activities and teaches students how to assess their own physical fitness by learning physiology of exercise concepts, as well as how to develop a physical fitness program for themselves,

based on their own needs.

The first step towards developing a prescribed exercise program in physical education for high school students is to homogeneously group students according to their physiological needs. In order to homogeneously group students--because of the myriad of managerial tasks that physical educators must handle--a computer program is an absolute necessity for measuring the accomplishments and general recordkeeping. Physical education teachers generally have a larger number of students in their classes than do academic teachers. School standards for grouping students need to be developed based on the five components of fitness. Class lists of the various homogeneously-grouped classes need to be generated, attendance lists composed, and a grading system established which holds students accountable for improvement. The computer program also helps in the research in order to evaluate the progress of the physical education program.

The Forest View High School physical education computer program enables the physical education administrator/teacher to homogeneously group students based on health-related fitness scores so that exercise may be prescribed for students by teachers. This program allows for the use of local fitness norms or national fitness norms in order to group and regroup students accurately.

This program will print student class lists and attendance lists for teachers. It will store students' records throughout the year, as well as compute up-to-date information as it is entered into the computer. It computes students' grades in physical education according to the grading standards established by the physical education administrator/teacher. It will compute students' grades at the end of the quarter or semester.

In the past two years, using a physiological approach to physical education and with the use of the computer and this computer program, the educational outcomes in our physical education program have met with great success by the students at Forest View High School.

FOREST VIEW HIGH SCHOOL PHYSICAL EDUCATION PROGRAM

Physical Education is an integral part of the total educational process which contributes to the physical and mental development of the individual. The Forest View Physical Education Program places its major emphasis on why exercise and fitness are important, what one's own fitness needs are, how to attain and maintain fitness throughout one's life, how to develop the necessary physical skills that allow for participation in activities that contribute to one's fitness, and how to adopt a lifestyle which promotes one's own health and fitness. Physically fit people are more productive and healthier members of society.

STUDENT OUTCOMES:

1. Students will know that physical activity is enjoyable.

2. Students will know that physical activity is important and will realize the value of being physically fit.

3. Students will understand that leisure-time games and activities are a means toward achieving physical fitness.

4. Students will understand the relationship between physical inactivity and various diseases.

5. Students will understand the role of diet and fat control in improving health.

6. Students will understand misconceptions about fat control.

7. Students will know physiology of exercise concepts and be able to relate them to physical fitness and health.

8. Students will know that prescribed exercise is based on physiological needs.

9. Students will know how to evaluate their own physical fitness.

10. Students will evaluate their own physical fitness and develop their own fitness profile.

11. Students will know the best available methods, techniques, and programs for developing physical fitness.

12. Students will know how to develop their own individualized fitness program based on their own physiological needs.

13. Students will know how to select lifetime sports and physical activities that will maintain and/or improve the areas of physical fitness and skill that they need to improve.

14. Students will know how to distinguish exercise quackery from sound, safe principles of exercise.

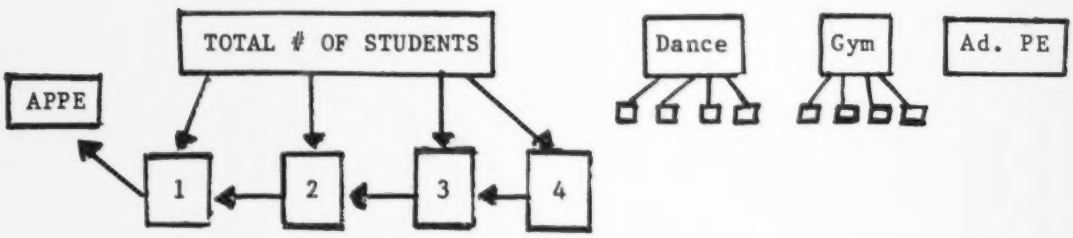
15. Students will improve their physical fitness, overall health, and self-concept.

PHYSICAL EDUCATION PROGRAM - FOREST VIEW HIGH SCHOOL

I. Physiological Test
   - A. C/V - 12 min. run
   - B. Body Composition - Skyndex
   - C. Flexibility - Sit and Reach
   - D. Strength - Handgrip Dynamometer
   - E. Muscular Endurance - Sit ups

II. Determination of Standards for Grouping
   - A. Rank Scores (each student) for each fitness component
   - B. Determine standards for each fitness component
   - C. Assign rank scores for standards (1-4)
   - D. Determine "weighting" of each fitness component based on needs or goals, (importance)
   - E. In each fitness component, student's score determines the rank; rank times weighting equals score for that component
   - F. Determine student's composite score by adding all of the scores for each fitness component.
   - G. Rank all composite scores and determine appropriate cutoffs for grouping. Standards are developed for groups 1 - 4

III. Homogeneous Grouping of Students
   - A. Group 4 - Students who need the most improvement
   - B. Group 3 - Students who are average and below
   - C. Group 2 - Students who are average and above
   - D. Group 1 - Students who have achieved the highest level of fitness
   - E. APPE - Students who qualify for Group 1 and select this class - higher intensity and expectations for students
   - F. Dance I, II and Orchesis - Students are tested and grouped, but remain in Dance Class - same requirement as regular P.E. with more emphasis on Dance.
   - G. Gymnastics - Students are tested and grouped, but remain in Gymnastics class - same requirement as regular P.E. with more emphasis on Gymnastics
   - H. Adaptive Physical Education - Students must be referred by a physician. Students out of the regular physical education program for 3 weeks or longer. Students are placed on individually prescribed programs from a physician.



IV. Approximately 20% of student's work will consist of a cognitive experience

A. Lectures
   1. Cardiovascular Fitness
   2. Body Composition - nutrition
   3. Muscular Strength — Relationship to health
   4. Muscular Endurance
   5. Muscular Flexibility

B. Written Test
   1. Terminology
   2. Physiology of exercise concepts
   3. Exercise "myths"
   4. How to prescribe exercise

C. Personal Fitness Profile
   1. Students evaluate their own level of fitness
   2. Students examine their personal fitness records. Look for strong and weak components of fitness.
   3. Students project what they may be like in health and appearance at age 40 if they continue current life style.
   4. Students write their own personal fitness program based on their own profile.
   5. Students select games and activities that improve fitness and health as recreational activities.

V. Prescribed Exercise Programs

A. Teachers will prescribe exercise for each group that will improve fitness and health of students.

B. Teachers will use the following criteria when developing plans for each group so that exercise is neither too difficult nor too easy, but rather a plan of gradual improvement
   1. intensity
   2. frequency
   3. duration
   4. "overload" principle
   5. "specificity" principle

C. Teachers will plan activities that will improve all components of fitness. Activities include:
   1. Direct Fitness Activities
   2. Games (individual - team)
   3. Recreational (leisure time activities)

D. Teachers will help students develop skill in activities so that students can be successful and enjoy the activity.

E. Participation in various games and activities will demonstrate and teach students how they affect all components of fitness so that students will be able to select activities that will best fulfill their own physiological needs.

VI. Retest Students Fitness Levels

A. Students are retested for improvement when they wish to be tested.

B. Students may improve to the next group anytime they test and reach that group's standards.

C. If student's retest score indicates, he may be moved down to the next group.

VII. Grading Procedure
- A. 60% of grade is based on improvement
- B. 20% of grade is based on written work
- C. 10% of grade is based on participation
- D. 10% of grade is based on final group placement.

VIII. Grading Procedure
- A. Collect Data on Student Outcomes
  1. number of students that improve in each fitness component
  2. amount of student improvement in each fitness component
  3. number of students that move up to another group.
  4. collect data on student's written work
  5. compare/evaluate standards
     a. each fitness component
     b. composite score
  6. Evaluate student's progress towards all goals of the program

IX. Evaluate Program
- A. Are students attaining goals of the program?
- B. If yes, to what degree?
- C. If no, why?

X. Plan for Program Changes

APPLEWRITER AND EASY IEP GENERATION

By: James Gerry and Kathryn Tomasiewicz, Maercker School District #60, Clarendon Hills, IL

The Maercker IEP Writer is designed to generate IEP's using the Applewriter word processing program. This system provides an easy method of recording and storing students' records including: personal data, annual goals, specific objectives, and methods of evaluation. Reports are available on the computer screen for quick review, or in written form for staffings and cumulative files. Our teachers use the program during a staffing to generate the IEP needed by wheeling a computer right into the staffing and entering the data as necessary. The IEP is then printed, duplicated and presented.

The edit portion of the Maercker IEP Writer allows modification of the preprogrammed material (goals, objectives, methods) or the addition of new material to the data bank to accommodate individual needs and varying grade levels.

In order to take full advantage of the Maercker IEP Writer System, it is advised that the user become familiar with the Applewriter word processing program. In fact one of the strongest points of this system is that it is fully integrated with the word processor. Thus, with the word processor, the user can custom modify the parts of the system or an individual IEP. THESE PROGRAMS WILL NOT WORK WITHOUT THE APPLEWRITER PROGRAM. Applewriter is a trademark of Apple Computer, Inc.

We attended the MICRO-IDEAS' conference in the Spring of 1983 and listened to a presentation by Gerry Zeller on the programming uses of Applewriter. This planted a seed in our minds that we developed into a working and efficient tool during the following summer.

This program is an extension of Gerry Zeller's idea of a data bank, accessed by the programming language available in Applewriter, to create tests. Our program uses the same basic concept, but moves in a different direction, allowing us to create individual IEPs from data banks of goals and objectives. We have written all of our own programs to make our system menu driven and user friendly. (We had to make it simple enough for one of our "non-user" teachers.)

The idea for this presentation is a direct result of having attended the MICRO-IDEAS Conference. It is a good example of the concept that attending a Conference, where ideas are shared, can foster the growth of other valuable ideas and programs.

INTRODUCTION AND PROGRAM DESCRIPTION OF THE MAERCKER IEP WRITER

Introduction

The Maercker IEP Writer is designed to generate IEP's using the Applewriter word processing program. This system, written with the Word Processing Language (WPL), provides an easy method of recording and storing students' records including: personal data, annual goals, specific objectives, and methods of evaluation. Reports are available on the computer screen for quick review, or in written form for staffings and cumulative files. Our teachers use the program during a staffing to generate the IEP needed by wheeling a

computer right into the staffing and entering data as necessary. The IEP is then printed, duplicated, and presented.

The Edit portion of the Maercker IEP Writer allows modification of the preprogrammed material (goals, objectives, methods) or the addition of new material to the data bank to accommodate individual needs and varying grade levels.

Hardware and Software Requirements

The programs are designed for use with any Apple II computer which can run Applewriter version II or version IIe, with two disk drives and a printer. This will require:

HARDWARE

Apple II+ with minimum of 48K
Apple IIe
2 disk drives
40 or 80 columns supported (By Applewriter)
Printer (Optional, but highly recommended, Underlining is not possible with an Epson printer.)

SOFTWARE

Applewriter II or Applewriter IIe

Program Description

The Maercker IEP Writer is comprised of four basic parts: student information, annual goals, behavioral objectives related to the goals, and methods of evaluation. These programs have been written in the WPL language supported by the Applewriter word processing system. THESE PROGRAMS WILL NOT WORK WITHOUT THE Applewriter PROGRAM. In order to take full advantage of the Maercker IEP Writer System, it is advised that the user become familiar with this word processing program. In fact, one of the strongest points of this system is that it is fully integrated with the word processor. Thus, with the word processor, the user can custom modify the parts of the system. For example, an IEP created by this system, or any goals, objectives, or methods used with the system, can be modified or added to by the user.

Student Information

Student information records personal data on each student and saves it on disk by the student's name. The program is set to include the following information:

- date
- school year
- student name
- grade level
- present school and district number
- receiving school and district
- program placement
- implementer
- initiation and review dates
- psychological evaluation date and re-eval date
- special services

P.E. program
% participation in regular education
staff member preparing IEP

Each entry is prompted on screen and any entry may be left blank.

The data items may be custom changed by request before purchasing the program.

Annual Goals
Annual goals presents a list of general goals in the following areas:

general functioning
study skills
reading
vocabulary
writing
spelling
grammar
handwriting
math
behavior
auditory
visual

Appropriate goals for each student can be chosen from the list and stored on the disk. Space is provided on the hard copy to the present level of performance for each child. Additional goals may be added to the core of those provided.

Behavioral Objectives
The objectives file contains specific objectives for each goal. The objective prompt will appear after a goal has been selected and entered into the computer. The desired objective is selected by entering its number, and is then displayed on the screen. At this point you may choose to accept it or not. The number of objectives that can be chosen is only limited to those that have been entered into the core of objectives on the disk. As with goals, additional objectives may be added to the core of those provided.

The check sheet is provided as an aid in preparing which goals, objectives, and methods will be selected for each student.

Methods of Evaluation
Methods of evaluation provides a list of options by which the objectives will be evaluated. These include:

grades
teacher observation
exercises
test scores
teacher reports/records
charts/graphs

After each objective has been chosen, the methods of evaluation for that objective are chosen by number. More than one method of evaluation may be chosen for each objective. There is an area to record the status of each objective at the time of review.

Print Option

After all the information for a student has been selected and saved on the disk it can then be printed. Page one includes personal information on the student and a list of the designated annual goals. Pages two and beyond contains key student information and then lists each goal, followed by its specified objectives, and methods of evaluation.

STUDENT AND PROGRAM EVALUATION

By: Robert Gerry and William Myers, Community Consolidated School District #21, Wheeling, IL

The recent package of educational reform bills, particularly Illinois Senate Bill #730 and House Bill #1070, will greatly effect school districts in Illinois. The parts of the reform package that are likely to have the greatest effect are the sections that deal with student outcomes, assessment of the degree to which the outcomes are being met, and the reporting of the assessment results to the public. These are all components of a student and program evaluation system already developed in School District #21 over the past ten years.

The framework within which it was possible to develop such a program was Program, Planning, Budgeting, and Evaluation System (PPBES), a program planning system modeled on the PPBS system in industry. The part that had not yet been implemented in 1977 was the Evaluation component. Program plan evaluation up to that point relied on individual teacher evaluation and, while it was adequate for individual classroom programs, grade level, school building, and district-wide evaluation were difficult to impossible to accomplish. Curriculum guides in each subject area had been developed that specified the objectives to be taught in each grade level as well as the ones to be mastered by students at each grade level. What was needed was a means of assessing whether or not the objectives were, in fact, being mastered. One of the limitations in developing such a system of assessment was the cost of technology available to collect large amounts of data and interpret it. With this in mind, the first end-of-year tests were developed to assess achievement of objectives in the areas of math, science, and social studies.

The answers for the tests were scanned during the summer of 1978 on a 3M scanning device that was transmitting the data over telephone lines to the 3M company in Minneapolis who then transmitted the data to a computer in Cleveland, Ohio for scoring. The results were transmitted to Elkhorn, Wisconsin where the reports were printed. The results were than hand-delivered to the school district. Once, after eight hours of scanning, a thunderstorm in Minneapolis caused the loss of an entire day's transmission of raw data. The process took the entire summer and part of the fall, and provided results at the classroom level only. It was obvious that a different process was needed.

At this time the Business Department in the district purchased an IBM 32, a small desk size mini-computer. The Department of Instruction worked with the Business Department to plan how to use the 32 to do the scoring of the tests. Since the necessary software was not available, a programmer from American Fork, Utah was hired to develop the scoring software as well as attendance and accounting programs for the Business Department. The collection of programs eventually became the package that IBM markets for schools, J & K Computer Systems School package. The district then purchased an Opscan 17, a moving-head scanning device. Now the district was able to gather data and summarize it to evaluate programs, individual student achievement, and proper placement of objectives. At this point, there were end-of-year tests in reading language, math, science, and social studies.

A significant part of the process has been to involve teachers in the development of the program by using committees to choose and place objectives, develop items, and revise tests. Teacher input led to the development of unit tests in math, science, and social studies rather than end-of-year tests. Eventually the reading tests were abandoned because the teacher input revealed that the test did not appropriately measure what was taught. At the same time, Learning Center teachers developed end-of-unit tests in Library Skills. By this time the IBM 32 was no longer capable of handling the testing system and business office services. An IBM System 34 was purchased to handle the greatly expanded program and an NCS 7001 was purchased for greater scanning speed and accuracy. The 7001 scanner is attached to an IBM 2741, a key-to-disk workstation, that allows raw data to be edited easily.

The current system is used for student and program evaluation in both a summative as well as a formative sense. Some of the testing occurs in a diagnostic-prescriptive form and some of the test results are used as part of the student grade. At the beginning of the year teachers mark scannable documents identifying the students in their instructional groups. This information is maintained in a file separate from the student enrollment file to enable the generation of answer sheets that have all of the identifying grid information preslugged to reduce errors. When teachers finish a unit, they fill out an order form for the test and send it through the interschool mail. They receive a box containing their classes' answer sheets and the requested number of tests in the mail the following day. They administer the test and send it back through the mail. Answer sheets are scanned and scored each afternoon and teachers receive their results in the following day's mail. The immediate turnaround time is necessary to make the results meaningful. There are a wide variety of reports available, but most teachers prefer to receive a concept report only. The scored results are then merged into a file containing results from other classrooms that year. At the end of the year teachers administer the end-of-year test in language and first and second grade math and science/social studies after which the year's data is summarized and reported for program analysis. Reports are generated that show how each grade level at each building performed on each concept with district averages for comparisons. These show the degree to which each concept was mastered district-wide with breakdowns by school and grade level. Another report provides an analysis of each test item and its effectiveness. The curriculum area coordinators use this data to identify areas that need to be addressed in terms of inservice, materials, and remediation. At the present time this system processes about 75,000 answer sheets a year.

By 1983 the number of individual tests had grown to one hundred thirty-seven and production of the tests was becoming very difficult. To alleviate the problem, the test items were entered into the computer through word processing software. Each item became a folio with its own six digit code. A local programmer developed software that would, upon request, randomly select items from among those items coded for a specific objective. The items selected for a group of objectives become a separate file which can be edited and printed. Where necessary, illustrations or diagrams are added. The test is then sent to the production department for printing. Shortly after this process was instituted, it became necessary to move up to an IBM System 36 with 512 K memory and a 400 Meg disk with both a line printer and a NEC character printer. There are about 2100 items each in the math, science, and social studies item banks from which tests are printed.

The end result of all of the development work is that the district's students and programs can now be evaluated on the district's curriculum and the E is a viable part of the PPBES system. There also appears to be significant data that the system has had an effect on how much students learn and on the effectiveness of the instructional program. The district administers the SRA norm referenced achievement test in the fall of each year. The average student score has changed dramatically since the implementation of criterion referenced testing in 1978. As Table 1 shows there has been an increase in the average student's score in each of the subject areas since 1978. The table also shows that, whereas in 1978 students would score at or below their EAS (ability) score, they now score at or above the EAS score. Although the table does not show the scores for the years in between, there was a consistent increase from grade 3 to grade 4 scores the following year and then to grade 5 the next year for each subject in nearly all the years between 1978 and 1984. Contrary to normal trends, students in District #21 from grade 3 to grade 8 show increasing achievement scores in most subject areas. Table 2 shows another trend in the test scores. Students are achieving such that fewer are falling in the lower national quartiles. The system seems to generally enable <u>all</u> students to move up into higher quartiles, not just the more able students.

Data provided on Tables 1 and 2 is for the Fall NRT tests for two years shown to demonstrate the trends. Complete data is available on request.

TABLE 1 - **SRA TEST SCORES** - District Wide - Average Students Score
(reported as national percentiles)

Tests	Year	Gr 3 %-iles	Gr 4 %-iles	Gr 5 %-iles	Gr 6 %-iles	Gr 7 %-iles	Gr 8 %-iles
Reading	1978	62	60	56	56	54	56
	1984	69	69	69	66	57	70
Math	1978	62	61	52	58	57	61
	1984	81	77	71	75	76	82
Language Arts	1978	57	66	57	63	59	56
	1984	71	77	70	73	65	75
Reference Materials	1978			58	59	60	64
	1984			71	71	66	80
Social Studies	1978			60	63	61	66
	1984			70	71	70	79
Science	1978			60	62	61	64
	1984			67	71	71	80
Composite	1978	65	65	60	63	60	58
	1984	80	75	74	75	68	77
EAS*	1978	65	71	63	66	61	64
	1984	66	72	75	77	72	79

*Educational Ability Survey - A norm referenced ability test score.

TABLE 2 - **PERCENT OF STUDENTS IN QUARTILES BY GRADE** - SRA Achievement
(reported as % of N by grade level)

Composite Score	Grades	3		4		5		6		7		8	
	Years	80	84	80	84	80	84	80	84	80	84	80	84
	4	42	52	33	44	36	46	44	53	35	45	42	59
National	3	27	29	33	33	29	28	29	26	30	27	28	24
Quartiles*	2	19	16	21	19	21	20	16	16	22	21	20	13
	1	12	3	13	5	14	7	11	5	13	7	10	4

*Quartiles	Percentiles
4	76-99
3	51-75
2	26-50
1	1-25

The most reasonable suggestion as to why a criterion referenced testing system would affect student achievement scores would be that teachers are focusing on specific objectives and attempting to insure that most students reach mastery on those objectives. There is a fair amount of evidence in the area of effective teaching research on the value of "teaching to objectives" in order to increase student learning. The results of the District's mastery learning approach would appear to substantiate those findings.

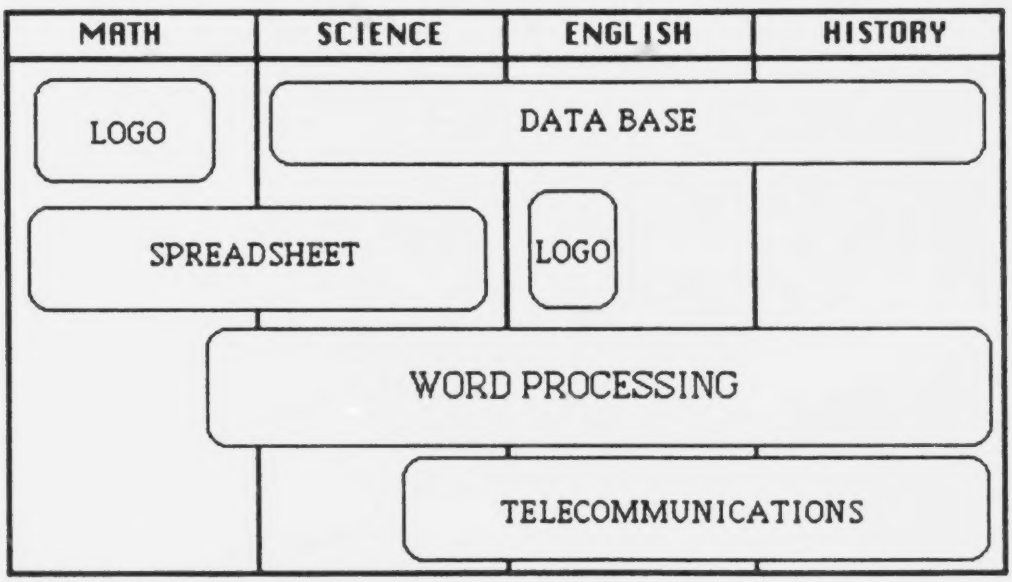
The area that did not show equivalent achievement gains was the area of reading. It may well be due primarily to the fact that the reading testing was discontinued. Recently the Ginn reading series was adopted and Ginn is developing an evaluation component using microcomputers and a software package owned by NCS (National Computer Systems) called the Instructional Management System or IMS. Ginn has placed their objectives and resources into the program's files and is piloting it in several school districts, one of which is District #21. The hardware required is an IBM PC-XT with a high speed printer and a NCS Sentry 3000 scanner. There are pre and post tests for each unit/level of the reading series with the ability to retest only the objectives not mastered on the pretest. The program generates reports for the class, individual remediation reports and parent letters detailing student progress on the objectives. The system is being piloted in two schools in the district - an elementary and a junior high school. Teachers like the system very much, though it may be too early to know if the system will have positive effects on student achievement. The only barrier to full implementation might be the rather high costs of the software and its maintenance contracts.

The purpose of the three areas of the school reform legislation previously mentioned is to address the issue of accountability. An evaluation system, such as the one established in District #21, meets the state goals and provides the necessary accountability to the students and community.

TOOLS FOR THE CLASSROOM

By: Michael Gordon and Michael P. Warner, CADRE, Glen Ellyn, IL

SUBJECT AREA USE OF BASIC COMPUTER TOOLS



Programming (Logo) - Logo is a programming language designed specifically for students. It is easy to learn and promotes high level thinking skills. Logo's turtle graphics make it a natural in the geometry class, and its ability to do list processing makes Logo useful in the English class.

Word Processing - A word processor can be thought of as an electronic typewriter, only the words appear on the screen instead of paper. It is easy to change what you have written, and can perform operations such as Find and Replace and Move on the text.

Data Base - A data base can be thought of as an electronic card filing system. You have an almost unlimited number of cards to place information on. Once the cards are filled out you can arrange them in any order (alphabetical, numerical, etc.) or can use them to print out reports and mailing labels.

Spreadsheet - A spreadsheet can be thought of as an electronic ledger sheet, with many rows and columns in which to place numbers or labels. The spreadsheet handles all the calculations once set up properly.

Telecommunications - Computers can communicate with other computers through phone lines. Using a modem, it is possible to access large amounts of information using services such as Dialog and BRS.

WORD PROCESSING
FIND AND REPLACE

The word processor can be used in many different situations - any subject area which requires writing can make use of the word processor. The capabilities of the word processor allows the teacher to create unique worksheets for their class. Below is an application of the word processor in the math class.

The computer would contain this word processing document:

1. Name had ! fruits. Name gave 4 fruits to friend. How many fruits did name have left?

2. Friend sold 2 fruits to the mailman for $*each. How much money did friend receive?

3. Name walked @ miles to get to the place at 4 miles per hour. How long did it take?

4. If name spent $* at the place to buy six fruits, how much would 1 fruit cost?

The directions for the students would be as follows:

Follow these directions to create your own story problems. As you complete each direction, place a check next to its number. As you complete each instruction remember to move the cursor back to the beginning of the text.

_____1. Find "name" and replace with a name of your choice.
_____2. Find "fruit" and replace it with a type of fruit.
_____3. Find "friend" and replace it with a name.
_____4. Find "!" and replace it with a number bigger than 10.
_____5. Find "@" and replace it with a number bigger than 100.
_____6. Find "place" and replace it with the name of a place.
_____7. Find "*" and replace with a number.
_____8. Save the file to your data disk.

A typical student printout may look like this:

1. Mike had 14 pears. Mike gave 4 pears to Pam. How many pears did Mike have left?

2. Pam sold 2 pears to the mailman for $18 each. How much money did Pam receive?

3. Mike walked 234 miles to get to the airport at 4 miles per hour. How long did it take?

4. If Mike spent $18 at the airport to buy six pears, how much would 1 pear cost?

File: Period 1 Report: Warm/Cold Arrange

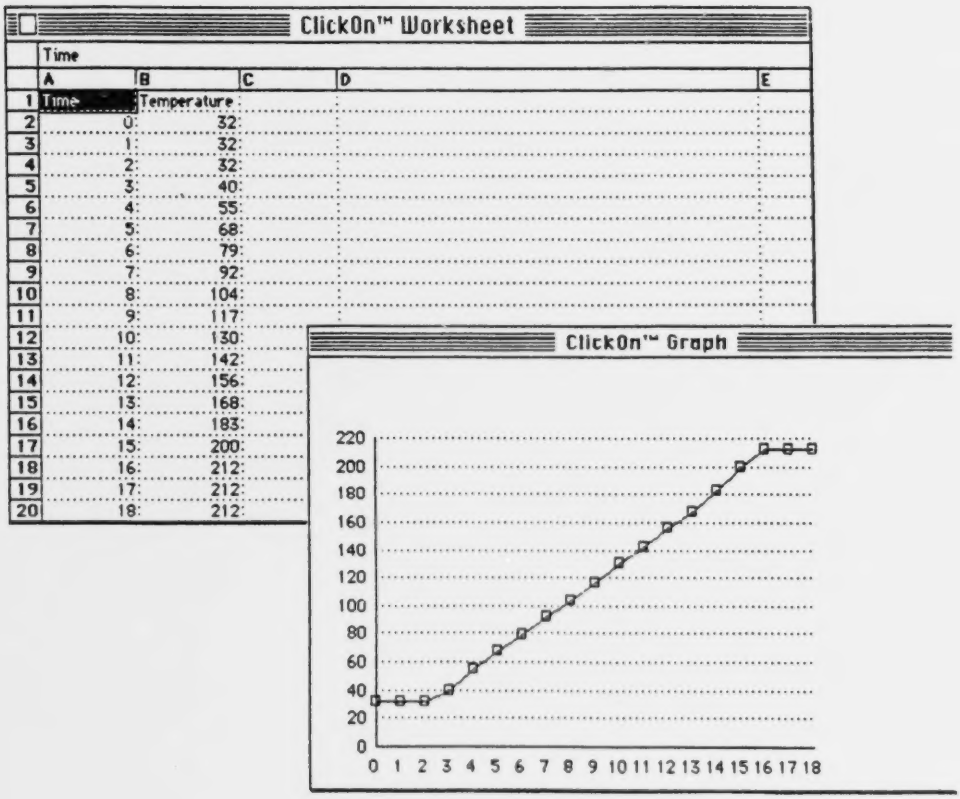
Name	Weight	Classification	Cold or Warm blooded	# legs
shark	125	fish	cold	0
worm	.05	invertibrate	cold	0
rattle snake	2	reptile	cold	0
snapping turtle	1	reptile	cold	4
tree frog	.1	reptile	cold	4
ostrich	180	bird	warm	2
robin	.5	bird	warm	2
turkey	20	bird	warm	2
beaver	5	mammal	warm	4
big horned sheep	200	mammal	warm	4
giraffe	425	mammal	warm	4
kangaroo	220	mammal	warm	4
lion	225	mammal	warm	4
mountain lion	175	mammal	warm	4
panther	125	mammal	warm	4

File: Period 1 Report: Legs Arrange

Name	Weight	Classification	Cold or Warm blooded	#legs
rattle snake	2	reptile	cold	0
shark	125	fish	cold	0
worm	.05	invertibrate	cold	0
ostrich	180	bird	warm	2
robin	.5	bird	warm	2
turkey	20	bird	warm	2
beaver	5	mammal	warm	4
big horned sheep	200	mammal	warm	4
giraffe	425	mammal	warm	4
kangaroo	220	mammal	warm	4
lion	225	mammal	warm	4
mountain lion	175	mammal	warm	4
panther	125	mammal	warm	4
snapping turtle	1	reptile	cold	4
tree frog	.1	reptile	cold	4

File: Period 1 Report: Weight Arrange

Name	Weight	Classification	Cold or Warm blooded	# legs
worm	.05	invertibrate	cold	0
tree frog	.1	reptile	cold	4
robin	.5	bird	warm	2
snapping turtle	1	reptile	cold	4
rattle snake	2	reptile	cold	0
beaver	5	mammal	warm	4
turkey	20	bird	warm	2
shark	125	fish	cold	0
panther	125	mammal	warm	4
mountain lion	175	mammal	warm	4
ostrich	180	bird	warm	2
big horned sheep	200	mammal	warm	4
kangaroo	220	mammal	warm	4
lion	225	mammal	warm	4



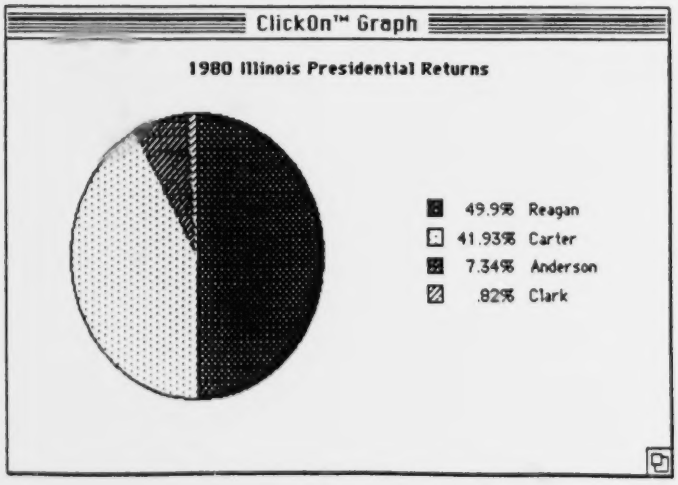


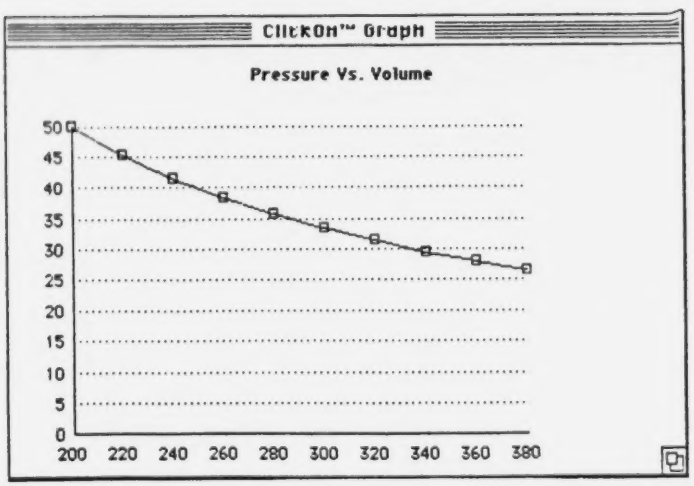
FIGURE 1 - GRAPHS

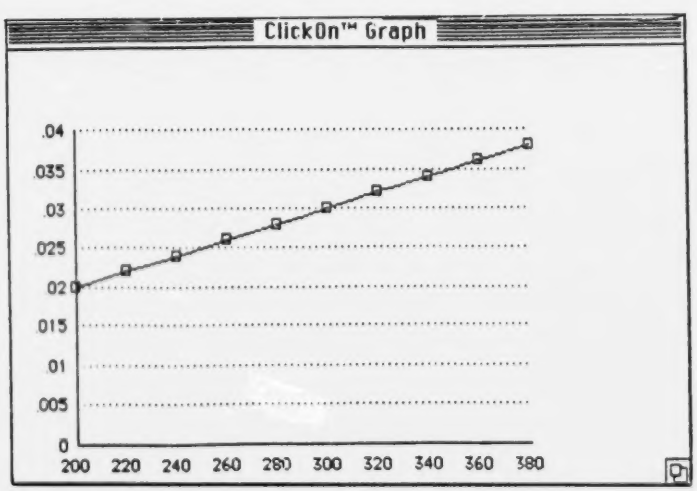
116

FIGURE 2 - GRAPHS

P/v

	A	B	C	D	E	F
1	Pressure	Volume	1/Volume	Pressure X Volume		
2	200	50	.02	10,000		
3	220	45.45	.0220022	9,999		
4	240	41.67	.02399808	10,000.8		
5	260	38.46	.02600104	9,999.6		
6	280	35.71	.02800336	9,998.8		
7	300	33.33	.030003	9,999		
8	320	31.25	.032	10,000		
9	340	29.41	.03400204	9,999.4		
10	360	27.78	.03599712	10,000.8		
11	380	26.32	.03799392	10,001.6		
12						
13						





File 261:UPI NEWS - APR 84 - FEB 86
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Set Items Description
--- ----- -----------
?SSACID
S1 653 ACID
?SS RAIN
S2 3170 RAIN
?SS S1 AND S2
653 S1
3170 S2
S3 277 S1 AND S2
?SS FISH
S4 1266 FISH
?SS S4 AND S3
1266 S4
277 S3
S5 18 S4 AND S3

?T5/2/2-5

5/2/2
0198521
SECTION: International news
STORY TAG: acidrain
DATELINE: HELSINKI, Finland (UPI) July 09, 1985
TIME: 17:47PD CYCLE: am
PRIORITY: Regular WORD COUNT: 0456
Eighteen European nations and Canada signed an agreement Tuesday aimed at controlling air pollution and acid rain, but three of the main polluters, including the United States, refused to join in the accord.

5/2/3
0192973
SECTION: Washington news
STORY TAG: acidrain
DATELINE: WASHINGTON (UPI) June 05, 1985
TIME: 14:51pd CYCLE: am
PRIORITY: Regular WORD COUNT: 0383
Two Western congressmen Wednesday introduced legislation to curb acid rain by ordering cuts in sulfur dioxide emissions in the East.

5/2/4
0176959
SECTION: Washington news
STORY TAG: acidrain
BY: WERFELMAN, LINDA
DATELINE: WASHINGTON (UPI) March 14, 1985
TIME: 00:52ps CYCLE: pm
PRIORITY: Regular WORD COUNT: 0467
The administration has a duty to classify sulfur in the atmosphere as a pollutant and take steps to control it, environmentalists said today, threatening to sue if the Environmental Protection Agency does not act.

5/2/5
0176621
SECTION: Washington news
STORY TAG: acidrain
BY: WERFELMAN, LINDA
DATELINE: WASHINGTON (UPI) March 13, 1985
TIME: 13:34ps CYCLE: am
PRIORITY: Regular WORD COUNT: 0499
Environmentalists who blame sulfur in the atmosphere for acid rain said Wednesday they are prepared to sue to force the administration to list the substance as a pollutant and develop standards to control it.

?T5/5/4

5/5/4
0176959
SECTION: Washington news
STORY TAG: acidrain
BY: WERFELMAN, LINDA
DATELINE: WASHINGTON (UPI) March 14, 1985
TIME: 00:52ps CYCLE: pm
PRIORITY: Regular WORD COUNT: 0467
The administration has a duty to classify sulfur in the atmosphere as a pollutant and take steps to control it, environmentalists said today, threatening to sue if the Environmental Protection Agency does not act.

In a 91-page notice to be delivered today to EPA Administrator, Lee Thomas, the Environmental Defense Fund gave formal notice of its plan to sue if the agency does not act within 60 days to limit sulfur in the air as part of an effort to fight acid rain. "This action is aimed at eliminating a `Catch-22´situation which EPA has been using to avoid doing its job," said defense fund lawyer James Tripp. "Once EPA lists sulfur as an air pollutant, it will then have the basis for establishing a sulfur pollutant control program."

Charles Elkins, acting assistant EPA administrator for air and radiation, declined Wednesday to discuss the environmentalists´ action, saying he and other agency officials have not seen the formal notice.

"I don´t know what their legal basis is," Elkins said.

The government already regulates sulfur dioxide emissions generated by coal-fired power plants and industries. In its notice to Thomas, the defense fund called for controls on all man-made forms of sulfur in the atmosphere. Sulfur dioxide and other forms of sulfur are believed by many experts to be a key element in acid rain, which is blamed for polluting lakes and streams, killing fish and damaging forests. Others say the precise cause of acid rain is unknown and other pollutants also are responsible.

"EPA has non-discretionary authority under the Clean Air Act to list sulfur as a pollutant and then to set standards which will reduce acid rain," Tripp said. "Since sulfur is the major contributor to surface water acidification," he added, "we have notified EPA of our intention to sue if EPA does not list sulfur and then use the authorities of the Clean Air Act to control sulfur deposition promptly."

In a letter to Thomas, the defense fund said the EPA´s own scientific studies "compel findings that emissions of atmospheric sulfur in any chemical form cause or contribute to air pollution which may reasonably

be anticipated to endanger health and welfare. ...Because of EPA's own findings, it has a duty to list atmospheric sulfur as an air pollutant." Under the law, once the EPA lists a chemical as a pollutant, it then must set limits on emissions and determine how much of the substance can be tolerated in the air.

?LOGOFF
11feb86 19:02:36 User 077486
$2.02 0.135 Hrs File261
$0.00 5 Types in Format 2
$0.00 1 Types in Format 5
$0.00 6 Types
$2.36 Established total session cost 0.158 Hrs.

THE USE OF MICROCOMPUTERS TO EVALUATE TESTS AND STUDENT PERFORMANCE

By: Delwyn L. Harnisch, University of Illinois, Urbana-Champaign, IL

INTRODUCTION

The microcomputer revolution has occurred and the computer age is upon us. Although the "computer on a chip" was developed around 1974, its impact in education was not felt until personal computers became widely available in the early 1980s. These microcomputer systems are relatively inexpensive, very reliable and easily used by persons with no prior exposure to computer technology. Because of these characteristics, the microcomputer has had a major impact upon our society. The nation's schools have embraced the microcomputer and it is being used as an instructional tool in all subject matter areas. It is also widely used to promote "computer literacy" among the youth in our nation's schools. We are rapidly approaching the time when there will be a microcomputer in every school building. Microcomputers and their associated technology have also been employed at the college level and are gaining a greater integration into the curriculum as time rolls on. The purpose of this paper is to describe two applications of test analysis software and the role that computers have been employed within the field of educational measurement.

Computers in educational measurement have been used to construct tests, store collections of items, administer tests, analyze test results and report test results. These applications indicate that the computer is going to play an increasingly important role in the field of educational measurement in general and specifically in testing. Specific applications include the microcomputer being used in item writing, item banking, and test construction as well as the more traditional test scoring, analysis and reporting phases of testing. Next, I will discuss the analysis phase of testing which includes the test scanning and scoring process.

Automation of the scoring process has increased dramatically in the past decade. However, the automation of this process depends upon the use of multiple choice items and answer sheets marked by the examinees. Basically, the process is one in which the answer sheets are inserted manually or automatically one at a time and the examinee's item responses detected via optical means are encoded and transmitted to the microcomputer. Present day scanning systems process an answer sheet in about 5 seconds. A new class of scanners are appearing in which microprocessors are incorporated within them to control the scanning process and perform sophisticated analyses of the detected marks to separate actual responses from erasures and other contamination of the answer sheets. These scanners can also score the answer sheet as it is scanned and use a print mechanism to put the score on the answer sheet. However, this feature is not of much interest when the scanner is connected to a microcomputer.

The typical scoring process involves the comparison of the item responses made by the examinee with the answer key to produce a binary vector in which a 1 indicates a correct response and 0 an incorrect response. Summary scores are created for each student and for the class of students being examined. Typically, the item and test statistics computed include the difficulty and discrimination for each item, and the mean, standard deviation and reliability for the test. The remainder of this session will focus on the use of two

classroom testing software packages which provide item analysis for either guiding instruction or judging whether an item or student is functioning appropriately. The two packages are: Test Analysis Package (TAP) and the Student-Problem Package (SPP).

TEST ANALYSIS PACKAGE

The Test Analysis Package consists of three microcomputer programs which edit, score, summarize and analyze student test data. Some of the main features of the system include (1) a built-in editor which allows the user to create a student test data file without having to use a separate word processor or scanner, (2) a scoring mechanism which can score a test data file of 999 students and 254 items against either a stored answer key or one created by the user, (3) a report generator which summarizes the descriptive statistics for students, items, and the test, and produces a frequency distribution of test scores, (4) a test analyzer which generates various statistical summaries and graphical displays on test quality and student performance, and (5) a system utility which allows the user to select a subset of the total test items for inclusion in the item analysis, thus helping the user evaluate the best possible test.

TAP automatically generates the following output listed for a sample data set in Appendix 1: (1) a listing of student test scores in Appendix 2, (2) a student, item and test summary in Appendix 3, and (3) a frequency distribution of test scores in Appendix 4. In addition, the user has optional output available which includes the following for the same data set: (1) a matrix of scored student responses to test items in Appendix 5, (2) percent of correct responses to test items by quintiles in Appendix 6, (3) a graphical display of quintile distribution of correct responses in Appendix 7, (4) a frequency distribution of responses by quintiles in Appendix 8, (5) a table of point-biserial correlations by response options in Appendix 9, and (6) a table of item difficulty and item/test point biserial correlations in Appendix 10 for data entered in a binary form (1s and 0s).

The information provided by TAP is very helpful in revising test items and improving the quality of the assessment activity. Additional information from response patterns can be quite helpful in interpretation of the total score. The next software package, Student-Problem Package (SPP), is also intended for use primarily with multiple-choice items.

STUDENT-PROBLEM PACKAGE

The Student-Problem Package on the IBM-PC is a collection of three sub-programs for analyzing item response patterns. These analyses are based on Student-Problem (SP) curve theory. The SPP produces a number of statistical summaries and includes a Student-Problem Chart. The S-P Chart is very useful for identifying unusual student response patterns and items that are functioning in unexpected ways. In addition, the program allows for the analysis by various subsets of items like those specified in a basic skills curriculum and produces what is called a categorized S-P chart. In short, this feature provides a summary of the items clustered into groups on the basis of a particular type of problem or objective. Similarly, students and items with unusual response patterns are identified. Information from these S-P Charts can be extremely useful in guiding instruction and evaluating the overlap between a test and what is taught.

Response patterns for students are unusual to the extent that students answer

some easy items incorrectly while answering some difficult items correctly. A wide variety of factors may lead to an unusual response pattern. These include guessing, carelessness, test anxiety, an unusual instructional history or other experiential background, a localized misunderstanding that influences responses to a subset of items, or copying a neighbor's answers to certain questions. (See Harnisch & Linn, 1981; Harnisch, 1983 for further discussion of these factors.)

Response patterns for items are unusual to the extent that items are answered incorrectly by high scoring students (i.e., high total test score) and correctly by low scoring students. This situation suggests random responses by students, or something unusual about the content of an item, e.g., its wording or the nature of what is being asked.

S-P CHART

The S-P Chart is a matrix in which students (rows) are arranged from top to bottom in descending order of total test scores, and the problems or test items (columns) are arranged from left to right in ascending order of difficulty. The analysis consists of (1) descriptive statistics for items; (2) summary statistics for students, items, and the test; and (3) classification and frequency tables which classify students according to their response pattern index test performance, and items according to their response pattern index and item difficulty. The S-P Chart and each part of this analysis are described below of the sample data listed in Appendix 11.

An S-P Chart is given in Appendix 12. This chart associates students with (1) their test scores; (2) their Modified Caution Index (MCI) and Modified Caution Signal; and (3) their responses to each item. The first column of the chart contains the student identification number. The second and third columns, RAW and %, contain each student's test scores. RAW refers to the total number of items correct and % refers to the percentage of items correct.

The fourth column of the chart, IND, contains the Modified Caution Index. It is based upon information about an individual's response pattern. An MCI value of 0 corresponds to an "ideal" student; one whose response pattern is known from the test score. MCI's approaching 1 indicate that a student is responding randomly; that is, some easy items are missed while some difficult items are answered correctly.

The fifth column, SGN, contains the Modified Caution Signal. It represents the results of classifying students according to both their test score and their response pattern. Specifically, the Modified Caution Signal refers to each student's classification with respect to test performance (high or low) and MCI (high or low). A total of four classifications are possible:

Signal A = high test performance (greater than 50% of items correct) and low MCI (less than or equal to .3)
Signal B = high test performance (greater than 50% of items correct) and high MCI (greater than .3)
Signal C = low test performance (less than or equal to 50% of items correct) and low MCI (less than or equal to .3)
Signal D = low test performance (less than or equal to 50% of items correct) and high MCI (greater than .3)

The remaining columns of the table contain individual responses (correct = +,

incorrect = distractor chosen such as A,B,C,D,E to each problem/item).
There are two lines that can be drawn on the S-P Chart. The S-curve (solid line in Appendix 12) is drawn by placing a vertical line over each S whose position corresponds to the total test score earned by the student represented by that row. The S-curve is completed by starting at the bottom of the chart and connecting the top end point of each vertical line segment to the bottom end point of the line segment to the left end point of the line segment above it.

The P-curve (dotted line in Appendix 12) is drawn in a similar manner except that the roles of students and items are reversed. A horizontal line segment is drawn over each P whose position corresponds to the number of students correctly answering the item represented by that column. The P-curve is completed by starting at the bottom of the chart and connecting the right end point of the line segment above it.

DESCRIPTIVE STATISTICS FOR ITEMS

A table of descriptive statistics for each item of the Student-Problem Chart is contained in Appendix 12. The first row, PROBLEM NUMBER, contains the item numbers. The second row, ANSWER KEY, contains the correct response option for each item. The third and fourth rows, PROBLEM TOTAL and PERCENT CORRECT, contain summary scores for each item. PROBLEM TOTAL refers to the total number of students answering each item correctly, and PERCENT TOTAL refers to the percentage of students answering each item correctly. The fifth and sixth rows contains the MODIFIED CAUTION INDEX and the MODIFIED CAUTION SIGNAL.

The MCI for items is calculated in the same way as the MCI for students, except that the roles of students and items are reversed. Since high MCI's for items indicate random responses, these items should be examined closely by the test constructors and the classroom teacher. The MCI for items is a helpful index for understanding some of the item characteristics. The Modified Caution Signal for items refers to each item's classification with respect to difficulty (difficult or easy) and MCI (high or low). A total of four classifications are possible:

Signal W = difficult item (less than or equal to 50% of students answered correctly) and low MCI (less than or equal to .3)
Signal X = difficult item (less than or equal to 50% of students answered correctly) and high MCI (greater than .3)
Signal Y = easy item (greater than 50% of students answered correctly) and low MCI (less than or equal to .3)
Signal Z = easy item (greater than 50% of students answered correctly) and high MCI (greater than .3)

SUMMARY STATISTICS FOR STUDENTS, ITEMS, AND TESTS

Summary statistics for the classroom of students, the 24 mathematics items, and the mathematics test are provided in Appendix 12. The student summary contains AVERAGE RAW SCORE, STANDARD DEVIATION OF RAW SCORE, AVERAGE PERCENT OF ITEMS CORRECT, AVERAGE MODIFIED CAUTION INDEX, and STANDARD DEVIATION OF MODIFIED CAUTION INDEX. The STANDARD DEVIATION OF RAW SCORE indicates the variability or dispersion among all students' test scores. Likewise, the STANDARD DEVIATION OF MODIFIED CAUTION INDEX indicates the variability among all students' MCI's.

The problem summary contains AVERAGE ITEM DIFFICULTY, STANDARD DEVIATION OF

ITEM DIFFICULTY, AVERAGE MODIFIED CAUTION INDEX, and STANDARD DEVIATION OF MODIFIED CAUTION INDEX.

The test summary contains AVERAGE OVERALL STUDENT PERFORMANCE ON TEST, RELIABILITY COEFFICIENT, and DISPARITY COEFFICIENT. The RELIABILITY COEFFICIENT measures the internal consistency of the test. The DISPARITY COEFFICIENT indicates the discrepancy between the S- and P-curves for the test.

CLASSIFICATION AND FREQUENCY TABLES

Classification and frequency tables for students and items are provided in Appendix 12. The first table classifies students with respect to (1) test performance: high (Signal A or B) or low (Signal C or D); and (2) MCI: high (Signal X or Z) or low (Signal W or Y). The cells of the table gives the number (frequency) of items in each of the four possible classifications.

CATEGORIZED S-P CHART

The "categorized S-P chart" is another form of applying the S-P curve theory to report item response patterns to classroom teachers. This form of reporting can be applied with tests that have multiple items classified to a particular content category. First, the categories of items are arranged from easy to hard. Caution indices for students are given based on the ordering of items from easy to hard across categories. Appendix 13 provides a categorized S-P chart for the 18 students with the sample data set on 24 problems representing three item categories.

New information is gained from the categorized S-P chart which helps to further diagnose students' understanding of specific skills. This simple rearrangement of the response pattern helps to better understand student strengths and weaknesses and also the areas of the curriculum in need of greater coverage and emphasis.

The results from S-P analysis are dependent solely on the test or subset of items used in the test. If the validity of the test is questioned, then the S-P results based on such a test would have to be used with caution. The indices resulting from an S-P approach are based on groups of students, for example, students in a classroom/school or district, and not on an individual student. However, the S-P approach is relatively easy to apply with the use of a computer and package of Student-Problem programs available for the main frame and the microcomputer. The information gained from the pattern of item responses does not require any additional data gathering efforts to examine the coverage of topics based on the groups of students being analyzed. Information from computer generated S-P charts is readily comprehensible and is reported in a concise form that teachers and counselors can use in diagnosing strengths and weaknesses of their students.

REFERENCES

Harnisch, D.L., & Linn, R.L. (1981). Analysis of item response patterns: Questionable test data and dissimilar curriculum practices. Journal of Educational Measurement, 18(3), 133-146.

Harnisch, D. L. (1983). Item response patterns: Applications for educational practice. Journal of Educational Measurement, 20(2), 191-206.

APPENDIX 1

Sample Listing of Unscored Data Set (EXAMPLE) and Answer Key File (TAPKEY)

```
466351415444242534234323233 2
463451312444422233315424533 3
464442142243422233342325 4 42
45142311524441 3334251232544
470421345414222343335424233 4
46741443 214122133 3542224 4
468312315444132433315 245334
453451315444522233335324233 4
462421315414222333315422213 4
471413315444222233335344213 3
455451315444252333325322211 4
454411315445122243335322533 4
457431342 43 2 4313352142524
452221315444222335315324113 4
465213312544422251324 445233
4413 231244332222333532251 24
458421213144241131333222514 2
473451135143322323353231144
472211412344422233335323513 5
456331315444222133345324212 4
459441315445222333335424113 4
460414312444122142315122241 4
461111315443122133215321533 3
469421345444222343335324543 4
474333132244222431335424213 5
```

Characteristics of data: (File Summary)

Number of students: 25
Number of ID characters: 3
Number of items on test: 25
Number of possible responses: 5

Answer key file (TAPKEY): 42131544422233333532421 34

APPENDIX 2

Sample Listing of Student Test Scores

STUDENT ID NO.	SCORE	PERCENT CORRECT
466	14	56
463	16	64
464	9	36
451	13	52
470	20	80
467	11	44
468	15	60
453	21	84
462	21	84
471	20	80
455	20	80
454	17	68
457	12	48
452	21	84
465	9	36
441	15	60
458	12	48
473	15	60
472	15	60
456	20	80
459	21	84
460	13	52
461	14	56
469	21	84
474	14	56

APPENDIX 3

Sample Student Summary, Item Summary, and Test Summary

STUDENT SUMMARY

NUMBER OF TEST ITEMS = 25

AVG. TEST SCORE = 15.96
STD. DEV. OF TEST SCORE = 3.97
STD. ERROR OF MEAN = 0.79
SKEWNESS = -0.06
KURTOSIS = 1.65

NUMBER OF TEST SCORES = 25

ITEM SUMMARY

AVG. ITEM DIFFICULTY = 0.64

STD. DEV. OF ITEM DIFFICULTY = 0.18

TEST SUMMARY

RELIABILITY COEF. (KR-20) =0.71

APPENDIX 4

Sample Frequency Distribution of Test Scores

RAW SCORE	STANDARDIZED SCORE	FREQ	CUM FREQ	EACH * REPRESENTS 1 PERSON
21	627	5	25	*****
20	602	4	20	****
19	577	0	16	
18	551	0	16	
17	526	1	16	*
16	501	1	15	*
15	476	4	14	****
14	451	3	10	***
13	426	2	7	**
12	400	2	5	**
11	375	1	3	*
10	350	0	2	
9	325	2	2	**

APPENDIX 5

Sample Student Responses to Test Items

STUDENT ID NO.	ITEM NO. 000000000111111111122222 123456789012345678901234 5
466	001011111101010010110101 0
463	101110111011011101011001 0
464	100000010011011100110000 0
451	110011011000111001010100 1
470	111101101111101111011101 1
467	100000001011011011010100 1
468	000111111001011101011001 1
453	101111111011011111111101 1
462	111111101111111101010111 1
471	100111111111011111101111 0
455	101111111101111101110110 1
454	101111110011001111110001 1
457	101100010010010111001100 1
452	011111111111110101111011 1
465	000110011011000100001001 0
441	000110110011011111110010 1
458	111010011100010110010010 0
473	101001010011110111110010 1
472	001010011011011111110011 0
456	001111111111011011111110 1
459	101111110111111111011011 1
460	100110111011000101010100 1
461	001111110011011001110001 0
469	111101111111101111111001 1
474	000000011111010111011111 0

1 = CORRECT RESPONSE 0 = INCORRECT RESPONSE

APPENDIX 6

Sample Percent of Correct Responses to Test Items by Quintiles

QUINTILE FREQUENCY DISTRIBUTION OF TEST SCORES

QUINTILE	NO. OF SCORES	PROPORTION OF SCORES	SCORE RANGE
1ST	5	0.20	9-12
2ND	5	0.20	13-14
3RD	5	0.20	15-16
4TH	5	0.20	17-20
5TH	5	0.20	21-21

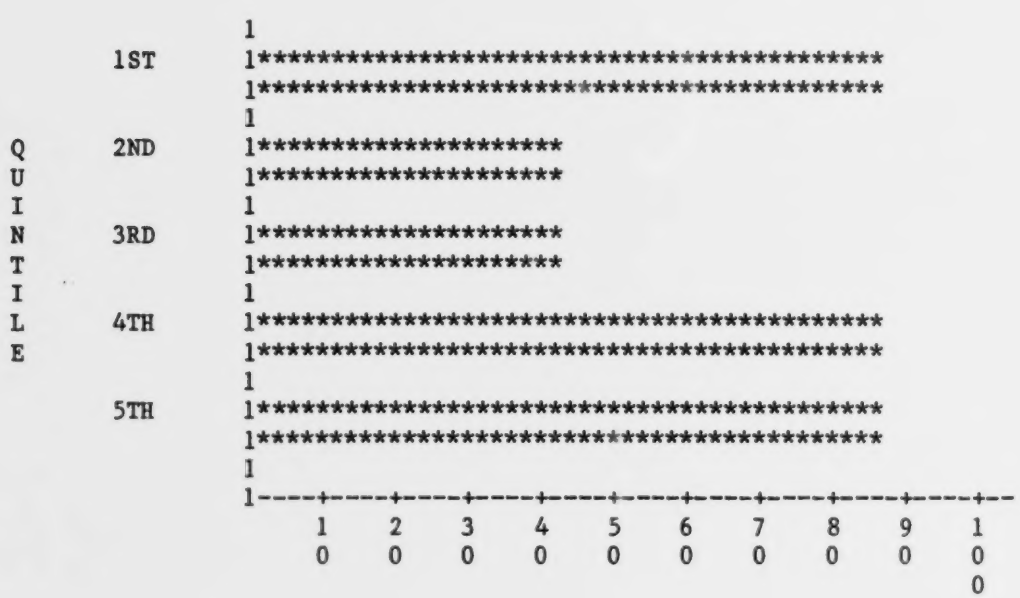
PERCENT OF CORRECT RESPONSES TO TEST ITEMS BY QUINTILES

ITEM #	1ST	2ND	3RD	4TH	5TH
1	80	40	40	80	80
2	20	20	0	20	60
3	40	40	60	80	100
4	40	40	60	100	100
5	40	80	80	80	80
6	0	60	40	100	100
7	0	60	60	100	100
8	80	100	100	80	80
9	60	80	60	80	80
10	20	40	0	80	80
11	80	60	80	80	100
12	60	80	100	100	100
13	0	20	20	40	80
14	80	80	100	60	80
15	40	40	80	100	80
16	80	40	100	100	100
17	60	40	60	60	60
18	40	80	100	100	100
19	20	40	60	80	60
20	60	100	100	80	100
21	40	20	40	60	80
22	40	80	0	80	40
23	20	20	60	60	60
24	20	60	60	60	100
25	40	40	60	80	100

APPENDIX 7

Sample Graphical Display of Percent of Correct Responses by Quintiles

Percent of Correct Responses By Quintile For Item Number 1



APPENDIX 8

Sample Frequency Distribution of Responses by Quintiles

*** ITEM 1 ***
FREQUENCY OF RESPONSES BY QUINTILES

RESPONSE OPTION	QUINTILE					PROP. OF RESPONSE
	1ST	2ND	3RD	4TH	5TH	
1	0	1	0	0	0	0.04
2	1	0	1	0	1	0.12
3	0	2	2	1	0	0.20
4*	4	2	2	4	4	0.64
5	0	0	0	0	0	0.00
OMIT	0	0	0	0	0	0.00

* INDICATES CORRECT RESPONSE

APPENDIX 9

Sample Point-Biserials by Response Options

POINT-BISERIAL CORRELATIONS BETWEEN RESPONSE OPTIONS AND TOTAL TEST SCORE

ITEM #	RESPONSE OPTION 1	2	3	4	5	OMIT
1	-0.10	-0.09	-0.05	0.14*	0.00	0.00
2	-0.30	0.29*	-0.06	-0.07	0.16	-0.05
3	0.53*	-0.28	-0.22	-0.30	0.00	0.00
4	-0.36	-0.21	0.54*	-0.25	0.00	0.00
5	0.22*	0.00	-0.25	-0.05	0.00	0.00
6	0.00	-0.54	-0.21	0.00	0.70*	-0.26
7	-0.19	-0.47	-0.05	0.72*	-0.36	-0.21
8	0.13	0.00	0.00	-0.13*	0.00	0.00
9	0.00	0.00	-0.38	0.20*	0.23	0.00
10	-0.25	0.59*	-0.07	0.46	0.26	-0.21
11	-0.16	0.15*	-0.05	-0.22	0.21	0.00
12	-0.21	0.34*	0.00	0.00	0.00	-0.26
13	-0.25	-0.13	0.54*	-0.22	-0.10	0.00
14	0.00	0.00	-0.01*	0.20	-0.36	0.00
15	-0.47	-0.15	0.39*	-0.10	0.26	0.00
16	0.00	-0.15	0.33*	-0.16	0.00	-0.26
17	0.10	-0.19	0.09*	-0.11	0.00	0.00
18	0.00	-0.36	-0.21	-0.34	0.56*	0.00
19	-0.22	-0.30	0.30*	0.17	0.00	-0.30
20	-0.21	0.22*	0.00	-0.11	0.00	0.00
21	-0.10	-0.06	-0.19	0.38*	-0.36	0.00
22	0.29	0.15*	0.00	-0.36	-0.21	0.00
23	0.38*	-0.36	0.12	-0.09	-0.26	-0.36
24	0.04	-0.03	0.41*	-0.42	0.00	-0.26
25	0.00	-0.41	-0.14	0.44*	-0.11	0.00

* INDICATES CORRECT RESPONSE OPTIONS

APPENDIX 10

Sample Item Difficulties and Item/Test Correlations

ITEM DIFFICULTIES AND ITEM/TOTAL TEST SCORE POINT-BISERIAL CORRELATIONS

ITEM #	ITEM DIFFICULTY	POINT-BISERIAL CORRELATION
1	0.87	0.37
2	0.30	0.47
3	0.70	0.26
4	0.43	0.31
5	0.43	0.33
6	0.43	0.40
7	0.60	0.46
8	0.43	0.35
9	0.40	0.64
10	0.53	0.24
11	0.47	0.57
12	0.47	0.51
13	0.50	0.56
14	0.43	0.68
15	0.67	0.29

APPENDIX 11

LISTING OF A SAMPLE INPUT DATA SET (SPFILE.DTA)

```
01 CEABDBBDEDBBECADCEDBDECA
02 DDADCBADEDDBBCECDECBEBCC
03 BECBABDDCDBBBCBCCECBAEAA
04 DBACAEDDDBBBCCCCCECBDAAC
05 BDACAEDDEDBBCCECDDCBDEAC
06 DBDCAEDDDDBBDCDCCECBBAAA
07 DCACADDDDBABCCBCCECDDAAC
08 CBACABDDDBCBCCCCCEDBDBAB
09 DBACAEDDDBBBCCCCBEDBDAAC
10 BACCDBCDEABBCCACBEBACECC
11 DBBAEEDDDBBBCCEBCDDBDABA
12 DDCCAE DDCBBCCDCCDDBD CC
13 BEACABEDEDBBCCCCCEDBBDEA
14 DCACAEDDCDDBCCACDECBDBCD
15 BEACABDDEBBBCCECC DBDCAC
16 CECCABDADBEBABBDCEDBCEAC
17 ABA CAEDDBCBACBCCECBBBED
18 DEB ABDDCDBBACECBEDBCECB
```

**** PROBLEM STATISTICS ****

Permuted Problem #	Answer Key	Problem Total	Percent Correct	Modified Ind/Sgn	Caution
12	B	18	100.0	0.00	Y
8	D	17	94.4	0.14	Y
14	C	17	94.4	0.14	Y
20	B	16	88.9	0.35	Z
16	C	15	83.3	0.17	Y
18	E	14	77.8	0.52	Z
5	A	13	72.2	0.13	Y
4	C	12	66.7	0.13	Y
7	D	12	66.7	0.17	Y
11	B	12	66.7	0.50	Z
17	C	12	66.7	0.40	Z
3	A	11	61.1	0.24	Y
13	C	11	61.1	0.15	Y
21	D	10	55.6	0.14	Y
1	D	9	50.0	0.28	W
9	D	9	50.0	0.17	W
19	C	9	50.0	0.36	X
23	A	9	50.0	0.14	W
24	C	9	50.0	0.36	X
10	B	8	44.4	0.19	W
6	E	7	38.9	0.15	W
2	B	6	33.3	0.13	W
15	C	4	22.2	0.10	W
22	B	4	22.2	0.52	X

APPENDIX 11 CONTINUED

**** STUDENT SUMMARY ****

Average raw score	= 14.67
Standard deviation of raw score	= 4.01
Average percent of items correct	= 61.11
Average modified caution index	= 0.18
Standard deviation of modified caution index	= 0.11

**** PROBLEM SUMMARY ****

Average item difficulty (%)	= 61.11
Standard deviation of item difficulty	= 3.89
Average modified caution index	= 0.23
Standard deviation of modified caution index	= 0.15

**** TEST SUMMARY ****

Average overall student performance on test (%)	= 61.11
Reliability coefficient (Cronbach's alpha)	= 0.74
Disparity coefficient	= 0.58

APPENDIX 12

EXAMPLE OF A REPORT GENERATED BY THE SP #1 PROGRAM

Student Problem (S-P) chart analysis of Sample SP Data Set
School: U of I, College of Education
Instructor: Jane Smith
Date: Feb 1985
Number of students: 18
Number of problems: 24

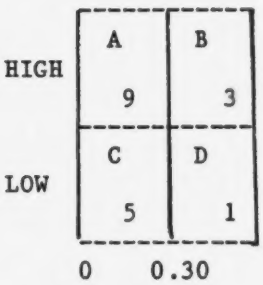
Student Number	Test Score (Raw)	Test Score (%)	Modified Caution Ind/Sgn	Problem Number 1 2	0 8	1 4	2 0	1 6	1 8	0 5	0 4	0 7	1 1	1 7	0 3	1 3	2 1	0 1	0 9	1 9	2 3	2 4	1 0	0 6	0 2	1 5	2 2
ANSWER KEY ==========>				B	D	C	B	C	E	A	C	D	B	C	A	C	D	D	D	C	A	C	B	E	B	C	B
04	23	95.8	0.00 A	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+SA
09	21	87.5	0.29 A	+	+	+	+	+	+	+	+	+	B	+	+	+	+	+	D	+	+	+	+S+	+	A
08	19	79.2	0.31 B	+	+	+	+	+	+	+	+	C	+	+	+	+	C	+	D	+	BS+	B	+	+	+
07	18	75.0	0.19 A	+	+	+	D	+	+	+	+	+	A	+	+	+	+	+	+	+	+S+	+	D	C	B	A
06	17	70.8	0.16 A	+	+	+	+	+	+	+	+	+	+	+	D	D	B	+	+	+S+	A	D	+	+	D	A
05	16	66.7	0.15 A	+	+	+	+	+	D	+	+	+	+	D	+	+	+	B	ES+	+	+	D	+	D P	E	E
14	16	66.7	0.20 A	+	+	+	+	+	+	+	+	+	D	D	+	+	+	+	CS+	C	D	D	+ P	C	A	-
15	16	66.7	0.09 A	+	+	+	+	+		+	+	+	+	+	+	+	+	B	ESD	+	+	+ P	B	E	E	C
12	15	62.5	0.17 A	+	+	+	+	+	D	+	+		+	+	C	+	+	+S+ P	D P	C P	+ P	C P	+	D	D	
11	14	58.3	0.36 B	+	+	+	+	B	D	E	A	+	+	+	B	+	+S+ P	+	D	B	A	+	+	+	E	A
13	14	58.3	0.13 A	+	+	+	+	+	+	+	+	E	+	+	+	+	BSB	E	+	E	A	D	B	E	+	D
17	13	54.2	0.32 B	+	+	+	+	+	+	C		E	C	+	+	ASB	A	+	+	E	D	+	A	+	B	+
03	12	50.0	0.07 C	+	+	+	+	+	+	+	B	+	+	+	CSB	A	B	C	+	+	A	D	B	E	B	E
02	11	45.8	0.26 C	+	+	+	+	+	+	C	D	A	D	DS+	B	E	+	E	+	C	+	D	B	D	E	+
16	11	45.8	0.35 D	+	A	B	+	D	+	+	+	+	E	+SC	A	A	A	+	D	+	+	+	B	E	B	E
18	10	41.7	0.04 C	+	+	+	+	+	+	+		+	+SB	B	A	C	+	C	D	C	B	D	B	E	E	E
01	9	37.5	0.10 C	+	+	+	+	D	+	D	B	BS+	+	+	E	+	C	E	D	C	A	D	B	E	A	E
10	9	37.5	0.13 C	+ P	+	+	A	+	+	D	+	CS+	B	C	+	C	B	E	B	C	+	A	B	A	A	E
Problem Number ==========>				1 2	0 8	1 4	2 0	1 6	1 8	0 5	0 4	0 7	1 1	1 7	0 3	1 3	2 1	0 1	0 9	1 9	2 3	2 4	1 0	0 6	0 2	1 5	2 2

APPENDIX 12 CONTINUED

**** CLASSIFICATION AND FREQUENCY ****

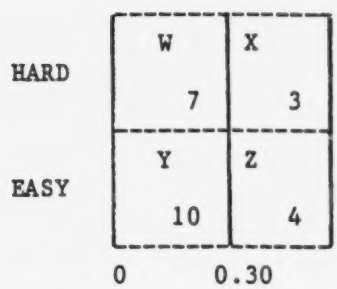
**** DISTRIBUTION TABLES ****

(1) Number of students in each cell classified by test performance and modified caution index



Student Performance	Student Cell	Percent Correct	Modified Caution Index
100%	A	> 50%	<= 0.30
	B	> 50%	> 0.30
50%	C	<= 50%	<= 0.30
	D	<= 50%	> 0.30
0%			

(2) Number of items in each cell classified by item difficulty and modified caution index



Item Difficulty	Item Cell	Percent Correct	Modified Caution Index
0%			
	W	<= 50%	<= 0.30
	X	<= 50%	> 0.30
50%	Y	> 50%	<= 0.30
	Z	> 50%	> 0.30
100%			

APPENDIX 13

EXAMPLE OF A REPORT GENERATED BY THE SP #3 PROGRAM

Student Problem (S-P) chart analysis of Sample SP Data Set

School: U of I, College of Education
Instructor: Jane Smith
Date: 02-01-85
Number of students: 18
Number of problems: 24

Student Number	Test Score (Raw)	(%)	Modified Caution Ind/Sgn	Problem Number 001020 12110121002 1010121 877319 20684140622 4531935
Category Name ==========>				Add'n Multipl'n Subt.
Answer Key ==========>				DDCADD BBCECBCBEBB CACDCAC
04	23	95.8	0.00 A	++++++ ++++++++++A +++++++
09	21	87.5	0.29 A	++B+++ ++++++++++A ++++D++
08	19	79.2	0.31 B	++++++ +++++CB+B++ +++CD++
07	18	75.0	0.19 A	++++++ +D+++A++DCA ++++++B
06	17	70.8	0.16 A	+++DB+ ++++++AD++A ++D+++D
05	16	66.7	0.15 A	++D++E +++D+++D+DE +++B++E
14	16	66.7	0.20 A	++D++C +++++DDD+C+ +++++CA
15	16	66.7	0.09 A	+++++E +++ ++++BEC +++BD+E
12	15	62.5	0.17 A	+ +C++ +++D+++C+D ++++DCD
11	14	58.3	0.36 B	+++B++ ++BDA+A+++A +E++DBE
13	14	58.3	0.13 A	+E++BE ++++++ADBED +++B+E+
17	13	54.2	0.32 B	+E++B+ ++++ CD+A++ +CAA+EB
03	12	50.0	0.07 C	+++CAC ++++B+ADBEE ++BB++B
02	11	45.8	0.26 C	+AD+EE ++++DD+DBD+ +CB++CE
16	11	45.8	0.35 D	A++CC+ ++D++E++BEE B+ACD+B
18	10	41.7	0.04 C	++BBCC ++++ +BDBEE ++A+DCE
01	9	37.5	0.10 C	+B+++E ++D+B+ADBEE +DECDCA
10	9	37.5	0.13 C	+CBCCE +A+++++ABAE +D+BBCA
Problem Number ==========>				001020 12110121002 1010121 877319 20684140622 4531935

APPENDIX 13 CONTINUED

**** CATEGORY STATISTICS ****

Category Rank	Category Name	Percent Correct
1	Addition	65
2	Multiplication	61
3	Subtraction	57

**** PROBLEM STATISTICS ****

Permuted Problem Number	Category Rank	Answer Key	Problem Total	Percent Correct	Modified Caution Ind/Sgn
8	1	D	17	94.4	0.14 Y
7	1	D	12	66.7	0.17 Y
17	1	C	12	66.7	0.40 Z
3	1	A	11	61.1	0.24 Y
21	1	D	10	55.6	0.14 Y
9	1	D	9	50.0	0.17 W
12	2	B	18	100.0	0.00 Y
20	2	B	16	88.9	0.35 Z
16	2	C	15	83.3	0.17 Y
18	2	E	14	77.8	0.52 Z
4	2	C	12	66.7	0.13 Y
11	2	B	12	66.7	0.50 Z
24	2	C	9	50.0	0.36 X
10	2	B	8	44.4	0.19 W
6	2	E	7	38.9	0.15 W
2	2	B	6	33.3	0.13 W
22	2	B	4	22.2	0.52 X
14	3	C	17	94.4	0.14 Y
5	3	A	13	72.2	0.13 Y
13	3	C	11	61.1	0.15 Y
1	3	D	9	50.0	0.28 W
19	3	C	9	50.0	0.36 X
23	3	A	9	50.0	0.14 W
15	3	C	4	22.2	0.10 W

NETWORKING APPLE II COMPUTERS

By: Steve Herring, Maine Township High School District 207, Park Ridge, IL

INTRODUCTION

The practical sciences have always required the ability to calculate numerical results to practical problems as well as to lend insight into natural phenomena. The famous mathematician, K. F. Gauss, was known to have investigated the truth of his theorems on number theory on number congruences. Moreover, the Scot, Napier, was approached by Tycho Braehe to develop mathematical methods for calculating the numerical results which were so needed in his astronomical calculations.

The need to communicate in order to manage business affairs is also not a recent development and evolved centuries before the introduction of high speed digital computers. The classic example is the prestigious House of Taxis, which served as messengers for merchants and royalty in Europe for over two centuries. Special messengers transported documents between specific locations or to a central location where they were correlated and processed and then transported in toto to their final destinations.

In more contemporary terms,

(1) the explosion of information,
(2) the low cost of digital computer equipment,
(3) the high cost of labor,
(4) the need for speedy information processing,

and (5) the desire to share information among several users,

have combined to produce systems called local area networks in the business community.

The impact of the introduction of digital computers into the science and business communities forced a change in contemporary educational priorities in the 1960's. Instruction in programming became a significant need to be satisfied only inadequately by so-called time-sharing networks.

With the development of the microcomputer, the nature of programming instruction and, ultimately of all of education, has undergone extensive changes in two areas of the school curriculum. First, in programming instruction,

(1) Students who were formerly restricted to theoretical aspects of programming or to infrequent practical interaction with a computer now may deal with a computer on a one-to-one basis.
(2) Output is immediate and so turn-around time is virtually a meaningless term. An output device is also a very tangible piece of hardware.

In other instructional areas,

(3) Teachers in nonprogramming classes--i.e., in other areas of the curriculum--have found microcomputers useful for instruction and classroom management.
(4) Simulations of formerly impractical experiments work well in a network system.

(5) Tutorials and interactive instruction are productive products of multi-user, multi-program networks.

The ultimate goal of a local network should be to produce a system that maximizes performance, flexibility, and security while simultaneously minimizing total cost.

REASONS FOR NETWORKING

Perhaps the most telling fact to consider is the sharing of programs and data by a large number of students. It is simply inconceivable and of questionable legality that a teacher boot a word processing program on 30 individual computers, for example. Furthermore, purchase of 30 copies of an individual program is not at all cost effective, and their use is an administrative nightmare. Using an interactive program which requires frequent disk access, such as one involving a sequence of keyboarding lessons, or one writing a number of files to storage, forces a complete re-thinking of the wisdom of stand-alone units.

A second reason for networking is to enable a number of users to share hardware, such as printers. It may be impossible financially for a school to purchase a large number of printers, and nearly every application is enhanced by hard copy output.

As a result of the proliferation of hardware in the standard classroom, the supervision of laboratory activities by older more traditional methods has frequently proved inadequate. Moreover, one simply cannot deal with questions and problems posed by 30 students at one time in a laboratory situation. As a result of the desire for increased control and more equitable laboratory instruction, the local network has entered the educational scene, and, as is always the case with innovations, has had significantly greater impact than the original reasons for implementation would have implied. CAI, CMI, TUTORIAL PROGRAMS, and SIMULATION are the practical effects of the introduction of networking into education.

(1) First, practical considerations may force the installation of a local network to monitor and control student activities on your computers. The initial impact of microcomputer developments was in programming instruction. The need to supervise classes in large laboratory settings of 25-30 students is clear to the experienced teacher. In addition, the task of assisting students with programming problems and advising them on their solutions is a monumental task.

A NETWORK WITH MONITORING AND MESSAGE COMMUNICATION CHARACTERISTICS IS A POSSIBLE SOLUTION FOR SUPERVISION AND CLASSROOM CONTROL.

(2) As frequently is the case, the development of a need for programming education and the arrival of low cost microcomputers in the classroom engendered further applications and needs. Teachers were quick to notice that the microcomputer could enhance their teaching in areas other than programming instruction. Computers provide excellent demonstration tools with instant responses. Graphing complex functions or even simple linear functions in the co-ordinate plane is very tedious and time consuming. Frequently, students become bored simply waiting for the promised graph. Multiple graphs

in a standard period is almost unthinkable. This important mathematical tool is a simple process for a computer, and, with a network, for an entire class. Furthermore, the introduction of the definite integral in calculus in terms of as an area calculation with upper and lower sums by hand is a long project, several days at best. It is not remarkable that networks have the ability to allow DEMONSTRATIONS to a large number of students simultaneously, each monitoring at an individual station. Data manipulation in science and histogram construction probably is omitted in many laboratory settings because it is just too impractical. A networked spreadsheet with overlay characteristics can allow individual data tallying.

NETWORKS ALLOW THE USE OF HIGH-SPEED PROGRAMMING TECHNIQUES TO ENHANCE AND EXPAND CLASSROOM ACTIVITIES WITH DEMONSTRATION CHARACTERISTICS.

(3) Tutoring students who are woefully inadequately prepared for classroom instruction heavily depends on the time availability of the classroom teacher. How does one deal with one or two of these students--not to mention a larger number of such students? And to devote more time to drill and practice situations probably means the focus point of instruction is lowered and better students horizons are not expanded. Indeed, there are remedial classes in every school with students progressing at highly differentiated rates. These students can benefit from CMI instruction techniques in which worksheets are called for, executed, and the results tabulated and saved for the classroom instructor.

NETWORKING CAN HANDLE THE ROUTINE TASKS OF DRILL AND PRACTICE WITH THE AVERAGE OR BELOW AVERAGE STUDENT WHILE ADDING TO THE BETTER STUDENT'S NEED FOR EXPANDED KNOWLEDGE WITH POSSIBLY INCREASED STUDENT INTEREST.

NETWORKS CAN MAINTAIN RECORDS AND REPORT PROGRESS TO THE INSTRUCTOR.

(4) The Millikan Oil Drop Experiment in science is probably one of the most notable approaches to solving a problem in physical chemistry, but it is simply not a possible laboratory activity and must be relegated to textbook discussion which often puts the ideas behind the experiment in a vague light. The simulation of election potentials in social science or the Huntington Science Programs, for example, on pollution in lakes are amazingly thought-provoking, yet without simulation cannot be considered for classroom instruction.

SIMULATION IS A CAPABILITY WHICH DEFINITELY INCREASES CLASSROOM PRODUCTIVITY AND WIDENS HORIZONS.

(5) The computer with a mass storage ability can supply the inquisitive student with a ready source of new material, say on matrix products and inversion in mathematics, which are often not a part of regular classroom instruction. Furthermore, ACT, SAT, and PSAT tutorials are a part of a growing number of software programs used regularly.

A NETWORK WITH A HARD DISK PERMITS A VAST LIBRARY OF INFORMATION TO BE ON LINE TO A LARGE NUMBER OF STUDENTS SIMULTANEOUSLY AS RESOURCE OR ENRICHMENT MATERIAL. MULTIPLE COPIES OF PROGRAMS AND LIBRARY MAINTENANCE IS MINIMAL.

(6) Word processing is a well-documented enhancement to student written essays in English classes. Keyboarding and typing classes are beginning to discover the microcomputer as a potential replacement for a standard typewriter in conjunction with a suitable software program.

NETWORKED WORD PROCESSING CAN BE A POTENTIAL BOON TO INSTRUCTION IN THESE AREAS.

These are just a few of the possible reasons to consider networking in your school. Networking has its problems and should not be considered as a universal panacea.

DEFINITION OF A NETWORK

It seems in order to delineate the features of a microcomputer network. By definition a local area network is a communication system consisting of a number of microcomputers (called STATIONS) interconnected by means of a cable in which interaction and data transmission occurs. Generally, this interconnection assumes that there is a central source of data storage and retrieval. Although it may happen that there is a central processing unit where data is manipulated (such as in a TIME-SHARING SYSTEM), the microcomputer network, in general, allocates the processing operation to the individual stations.

The individual stations must be connected to the network cable by an intelligent interface board which can intercept data or transmit it. Normally, the central data storage is accomplished with a Winchester hard disk drive system although at least one network, the Wolsten System, serves stations from and saves to floppy disk. Storage capacity is normally from 5 to 45 megabytes, although recent innovations have increased this capacity to 100 or more megabytes at reasonable cost. The term "local" generally restricts the network to a room or a building.

CONSIDERATIONS

There are several overriding considerations in setting up a network:

(1) the total number of stations to interconnect and their location;
(2) the uses to which the network will be placed;
(3) the total cost per station;
(4) the cost of additional stations added to the system at a later date;
(5) the communications and monitoring capabilities;
(6) the security of data;
(7) the interfacing capabilities;
(8) the vulnerability of the system to network failure or to station failure;
(9) the speed of data transmission;
and (10) the ease of maintenance.

Before deciding on a network to interconnect microcomputers, each of these questions needs to be addressed. It may, in fact, happen that there is no real need to network in an individual situation. Unless programs, data, or

hardware must be shared, a network may be of doubtful value. However, the decision is an individual one although we assume here that networking is in your computing future.

NETWORK TOPOLOGY

Networks of microcomputers are configured or arranged physically in one of three general topological patterns:

(1) the ring,
(2) the star,
or (3) the bus.

With respect to the network topology, the stations themselves are frequently referred to as nodes. The RING is a circular arrangement in which each computer is connected to its successor and its predecessor in the network by a cable connection. Control can be centralized by designating a specific station as a primary node or distributed with all nodes having equal status. The hard disk storage device is, in fact, one of the nodes in this type of network. Generally, this type of network is cost efficient in that its initial cost, as well as the cost to add additional stations, is restricted to cable, interface, and station cost. The network expansion itself, however, may require software and hardware changes in EVERY station. Security depends on the individual station security. Generally, in a microcomputer network, this requirement implies that security is difficult to maintain since all stations constantly monitor the network line for messages or data. Ring networks do not lend themselves well to interfacing different kinds of information transmission on the same system. Moreover, the ring is particularly vulnerable to the failure of a station since the ring is, in fact, generally broken and transmission to a central node like a hard disk may not be possible. Multiple failure can isolate perfectly operating nodes as well. This is generally a rather primitive and elementary type of networking without extensive modification. Transmission speed is not particularly fast. Monitoring and communications are highly dependent on the resident hardware and software.

An example of modern version of this type of microcomputer network is APPLE SCHOOL BUS. Another such network with modifications that has been announced for the spring is the IBM modified ring network which hopes to circumvent the problem of station failure by switching the offending station out of the network.

Next, the STAR topology consists of a central controlling device or processor called a host that communicates with outlying nodes along lines like the spokes of a wheel. This type of configuration is normally used to connect a large main frame computer to a number of remote terminals which may or may not have individual data processing capabilities. The classic TIME-SHARING systems are of this configuration. In the local network framework, the host, a microcomputer with hard disk drive attached, normally serves as a scheduling and communications device. A modified version of this type of network consists of a series of star patterns interconnected to a central host. This latter pattern is most prevalent in the microcomputer case and an example is the older CORVUS MULTIPLEXED VERSION NETWORK. The secondary hosts are multiplexer units rather than microcomputers, and they accommodate four stations.

This kind of system is particularly appropriate for networking since the central host controls data access to all nodes. Centralized networks like this are relatively reasonable in cost, but, in the modified star case may require additional secondary hosts whether all additional stations are wanted. The cost thus may be increased. This type of system offers good security characteristics and monitoring capabilities than its centralized arrangement would suggest. Access time is fairly slow since all communications have to be processed by the host. The star and the modified star systems are very vulnerable to host or secondary host failure: all systems connected to the failing host are down. However, an individual station failure will not, in general, affect the other computers in the network. Interfacing characteristics are quite good for this type of network. On a small scale the Wolsten System provides an example of a star topology.

The TREE or BUS network is a very common form of topology. On a bus network the stations are attached to a single cable (the branch) by means of so-called network taps. Each station is connected to the tap lines via an intelligent interface card which normally controls communication with the hard disk system which is placed at one end of the branch. Usually, one of the microcomputers in the network is designed for monitoring the network operations although this is certainly not required. Thus, it does not have a centralized controller or host. Communications among stations is quite possible. It has the added advantage that it is generally cost effective. Adding a station is simply the cost of the additional computer and the interface and cable. The failure of one station has generally no effect on any of the other stations. Access time is relatively good, unless many stations are attempting to access the hard disk simultaneously which, other than at boot up, is rare. Security is again station-dependent for the most part. Bus systems generally have superior interfacing capabilities with video, data, and voice information on the same system. An example of the bus topology is the CORVUS OMNINET HARD DISK SYSTEM.

THE WOLSTEN NETWORK

Quite a different network is represented by the Wolsten System. The node stations are connected directly by ribbon cables to a serving device. That device has one or two floppy disk drives connected to it and it, in turn, is connected to a master computer. In the configuration it resembles a star arrangement. Theoretically, each station which is on the network is booted with the software in the drive attached to the server unit. This is done in cycle until all computers asking for the software are served. One unit down does not cause failure in the other units, but a failure in the serving unit does. It must be noted that the network is really a multi-user, single program, single access system. If a program returns to disk often or frequent access is required, this system is limited. Use of several programs IS possible with disk swapping but not practical and, of course, limited to single access programs. Signal loss is a feature of parallel transmission over ribbon cable as well. The system comes in two models serving 8 or 16 slave stations. A distinct advantage of the Wolsten System is its ability to boot most protected software without modification. An overriding consideration in its purchase may be the cost which will probably exceed $2500. While it is generally cheaper than other networks, it is rather expensive for what you obtain.

THE CORVUS OMNINET NETWORK

A network which takes advantage of the bus line topology is the CORVUS OMNINET Network. It is capable of supporting up to 63 stations with no host station: each station directly addresses the storage unit which is typically a 45 MB hard disk through a disk serving unit. The serving unit and hard drive are normally combined into a single relatively compact unit which is addressed as node 0. Each station, including one which can be used for network management, is connected to the bus line (two-wire Belden cable with ground) via a two-wire cable and intelligent addressable interface which are supplied with a bus line tap box by CORVUS. This network, unlike the Wolsten, is a multi-program, multi-access, multi-user: there may be several users who use different programs with possibly different operating systems accessing the hard disk at different rates. It is to be noted that programs using DOS 3.3, ProDos, Pascal, CP/M, or MS-DOS may coexist on the CORVUS hard disk: each user will be assigned an appropriate boot system.

With proper applications software, the network users can share programs, data, and hardware while the manager theoretically has the option of monitoring the activities of certain users. The current version of the network management software, Constellation II, is vastly superior to the earlier version, Constellation I. It is entirely menu-driven and reasonably powerful. Its only major drawback is in the type of security it provides for current supervolume subvolumes: either all are write-protected or none are. To write protect some volumes, but not others, requires constructing individual volumes. Thus, we CAN satisfy the requisite need, but with an excess of labor. Undoubtedly, we may expect this option for future releases of the management software.

CONCLUSION

We do not mean to imply that the networking of a computer laboratory will solve all your computing, supervision, or instructional problems. Nor do we mean to suggest that associated CAI/CMI type programs will supplant more traditional modes of instruction. We do mean to suggest its proper use will enhance instruction.

To assist you in the installation of networking hardware and the management of the system, we provide you with a list of suggestions and a list of both hardware and software manufacturers.

1. **LOCATION OF NETWORK**

The network should be thought of in terms of 30 nodes (student stations) and a host station (teacher or master station) even though you may contemplate a smaller number of stations. Larger networks tend to be less practical for programming or CAI/CMI applications.

a. Choose a large room. It should provide space for tables holding the student stations and a remote master station location where the network management takes place. Remember to allow space for printers and peripherals--such as there may be. For example, you may want an overhead projector, a large screen projector, and a teaching station. Students will need space for books and papers, and you will want some storage space. (Major storage should be confined to an adjacent room.)

b. It should be in a secure area of the building, preferably on an upper floor and internally located.

c. The room should be centrally located to provide easy access for nonprogramming classes.

d. It is helpful to provide at least one adjacent classroom for instruction.

e. A room for teacher preparation is useful. It should be completely equipped.

2. **THE MINIMUM EQUIPMENT REQUIRED**

a. Tables to hold all stations.

b. 15 computers, monitors, and probably floppy disk drives.

c. 1 computer, monitor, two floppy disk drives, and a printer for the network manager's master station.

d. At least one printer for the network. More practically, one printer for each five stations. Best solution: a two-to-one computer station-to-printer ratio with two-way switches.

e. A hard disk drive, such as a CORVUS OMNINET 45 MB or other comparable networking capability.

f. A transporter card and cable for each of the student stations and the network manager's station. (Probably 16 or more.)

g. Belden type cable to provide the bus line.

h. Tap line boxes to allow access to the bus line. (These are usually supplied by the transporter card manufacturer.)

3. **LAYING OUT THE NETWORK**

a. There should be a set of switches available to the system manager and to the teacher which control the power to the equipment. The power to the computer, to the monitors, and to the printers should all be on three separate switches: it is convenient to switch off the monitors, for example, while instructing the class to remove a distracting influence.

b. One continuous bus line, rather than a "T" effect, should be employed. This structure encourages rapid response time from the hard disk or other central storage unit.

c. Plan for a security system.

d. There should be extra outlets.

4. **MANAGEMENT SOFTWARE**

CORVUS supplies these packages with each operating system--with DOS 3.3, for example. They allow formatting and management of the hard disk storage. (A word of warning: the manuals are, at best, inadequate; there is little technical information available. Find a friend who has experience with the system and share!) The software is currently called Constellation II. The old Software Connections Classroom Monitor has not been adequately updated to support Constellation II, in my opinion, although they are probably going to produce a new version. See it operate first!!!

5. **TECHNICAL SUPPORT**

CORVUS may be contacted only directly through a dealer. However, they have been helpful with specific questions.

6. **COST OF THE NETWORK**

These costs represent the most current available. However, it is clear that CORVUS plans to reduce prices over the next few months so that these prices will reflect the upper bound.

a. CORVUS OMNINET 45MB hard disk: $3300

b. Transporter Card/Cable/Tap Box: $175 each

c. Belden Cable for bus line: $100

d. Apple IIe starter unit: $900 each
Epson Equity I (IBM PC compatible): $900 each

e. CP/M Cards (if wanted): $75 each

f. Printer/Cable/Interface (Serial) -- ProWriter II (Same performance as ImageWriter II): $550 each

g. CORVUS Software Packages for DOS 3.3, Pascal, CP/M, and/or ProDos: $150 each (You need only one.)

h. Switches for printers (if wanted): $30-$100 each
Interfaces (if needed): $75 each

i. Other operating software: Ideal Learning is recommended: $500

7. **LICENSING SOFTWARE**

All software which is networked needs to be licensed for such operation from the manufacturer. Prices for a standard 30-unit system range from $100-$4,000. In my opinion, $2000 is upper limit for such sites and, more to the point, $500-$1,000 is reasonable. A good rule to estimate cost is unit cost times 30 stations.

8. **SOME USEFUL ADDRESSES**

Follows below.

9. **RECOMMENDED SOFTWARE**

a. Word Processors: MAGIC WINDOW/ACEWRITER II

(Intermediate Level -- power with relative ease of learning. Works with lots of printers and computers. Generates 70 column screen in software if you don't have 80 column cards or plan to mix older computers with Apple IIe's. Integrates with MAGIC CALC-ACECALC like Appleworks [my choice].)

b. Spreadsheets: MAGIC CALC--ACECALC--T.H.E. SPREADSHEET

This is simply the best spreadsheet for the money--hands down!

c. Keyboarding: Southwestern Software Package

d. Logo: Terrapin is good and a best buy as a network package.

e. MECC software packages are often excellent including, GHOSTWRITER, MUSIC THEORY, and the SOCIAL SCIENCE packages.

f. SAT Materials: NAACP and Microlab packages are worth looking into.

g. Ideal Learning CMI packages are outstanding and highly recommended. They provide complete courseware, a testing package, SCAN-TRON support, and written materials together with superior technical support. They are the best on the market.

ADDRESSES

Applied Microsystems P.O. Box 832 Roswell, GA 30077 404/371-0832 Contact: Russell Still	Algebra and Basic Programming
Artsci Inc. 5547 Satsuma Ave. North Hollywood, CA 91601 213/985-2922 Contact: Jo Hillard	AceWriter II/Magic Window/AceCalc/Magic Calc Mail list management, graphics, business programs
Avant-Garde Productions P.O. Box 30160 Eugene, OR 97403 503/345-3043 Contact: Mary Carol	English programs, Spelling, Grading, Reading, Logic, Geometry, Algebra, Functions, Etc.
American Software Publ. Co. P.O. Box 57221 Washington, D.C. 20037 202/887-5834 Contact: Sheryl Nutting	2500 Public Domain Software Programs on 55 two-sided disks
BLS/Random House School Div. 400 Hahn Road Westminster, MD 21157 800/638-6460	Programs in Mathematics, Algebra, Reading, Mechanics of English, Writing, Spelling, and Punctuation
Borg-Warner Educational Sys. 600 W. University Drive Arlington Heights, IL 60004 312/394-1010 Contact: Robert Morgan	SAT Programs, Programs in Critical Reading, Word Structure, Sentence Structure, Geometry, and Language Arts
Beagle Bros. Micro Software 4315 Sierra Vista San Diego, CA 92103 619/296-6400	Specialized Software
Compress P.O. Box 102 Wentworth, NH 03282 603/764-5225 Contact: Tom Sears	Programs in Chemistry, Organic Chemistry, ESL, English Grammar, Differential Equations, Evolution, and Genetics
Computer Network Specialists 400 S. Ramona/Suite 109 Corona, CA 91720 714/371-3277 Contact: Dave Dressler	Network Management System

Conduit P.O. Box 388 Iowa City, IA 52244 319/353-5789 Contact: Jim Levin	CAI Software
Cross Educational Software 1802 N. Trenton Street P.O. Box 1536 Ruston, LA 71270 318/255-8921 Contact: Connie Cross	CAI Software
Development Learning Materials One DLM Park Allen, TX 214/248-6300 Contact: Annette Schmidt	CAI Software
Edu-Ware Services Inc. (See Peachtree Software) 3445 Peachtree Road N.E. Atlanta, GA 30326 1-800-554-8900	CAI Software
Encyclopedia Britannica Educational Corp. 425 N. Michigan Ave. Chicago, IL 60611 312/321-6800 Contact: Thomas Creevy	Programs on Algebra, Mathematics, Biology, Chemistry, Computers, Grammar, Writing, Basic English Skills, History, Mythology and Electronics
Focus Media 135 Nassau Blvd. Garden City, NY 11530 516/248-8799 Contact: Seth Grenetz	CAI Software
High Technology Inc. P.O. Box 60406 2201 NE 63rd Oklahoma, OK 73146 405/524-4359	Chemistry and other Science Programs
Houghton Mifflin One Beacon Street Boston, MA 02108 617/725-5324 Contact: Karen Billings	Algebra and Geometry Software GIS System
Ideal Learning Inc. 1044 S. Fuller Street Shakopee, MN 55379 612/445-4884 Contact: Gary Volding	Excellent CAI Software packages keyed to objectives completely managed, testing package, network management system

Kensington Microware 300 E. 54th Street-Ste. 3L New York, NY 10022 212/486-7707 Contact: Betsey Dineen	Word Processing Software
Krell Software 320 Stony Brook Road Stony Brook, NY 11790 516/751-5139 Contact: Jack Cohen	Logo, SAT Preparation, ACT Preparation, CAI Software
Micro Power and Light Co. 12820 Hillcrest Rd./Ste. 224 Dallas, TX 75230 214/239-6620 Contact: Ed Frantz	A wide variety of CAI Software
MicroPro International 1299 Fourth St./Ste. 400 San Rafael, CA 94901 415/457-8990 Contact: Jan Swanberg	Wordstar
Milliken Publishing 1100 Research Blvd. St. Louis, MO 63132 314/991-4220 Contact: Chuck Eisenberg	Mathematics, Language Arts, Reading, Grammar, Spelling, Writing, Etc.
Milton Bradley Company 443 Shaker Road East Long Meadow, MA 413/525-6411 Contact: Tom Fanning	CAI Software
MECC 2520 Broadway Drive St. Paul, MN 55113 612/638-0613 Contact: Kent Kehrberg	A large variety of excellent software
Random House School Div. 400 Hahn Road Westminster, MD 21157 800/638-6460 Contact: Howard Zack	A large variety of excellent software
Scholastic Inc. 902 Sylvan Avenue Englewood Cliffs, NJ 07632 212/505-3000 Contact: Bob Didner	PFS Programs

Software Connections Inc. 1800 Wyatt Drive Suite 17 Santa Clara, CA 95054 408/988-3704 Contact: Gary Quok	Classroom Monitor
SRA 155 N. Wacker Drive Chicago, IL 60606 800/621-0476 Contact: Glen Philips	CAI Software
Sunburst 39 Washington Ave.-Room M5 Pleasantville, NY 10570 800/431-1934 Contact: Marge Kosel	CAI Software
South-Western Publishing 5101 Madison Road Cincinnati, OH 45227 513/271-8811 Contact: Kathy Shields	Accounting, Keyboarding, etc.
Stoneware Microcomputer Prod. 50 Belvedere Street San Rafael, CA 94901 415/454-6500 Contact: Al Dyer	DB Master
Terrapin Inc. 380 Green Street Cambridge, MA 02139 617/492-8816	Logo
John Wiley and Sons 605 3rd Avenue New York, NY 10158 212/850-6000 Contact: Lou Hallerback	Grading System, Chemistry Curriculum

ELEMENTARY COORDINATORS MEETING

Conducted by: James Hoffmann, Des Plaines School District #62, Des Plaines, IL

Types of Software

I. Utility

II. Curricular - chosen by
- A) committee by topic
- B) survey
- C) previewing
  1. company
  2. computer stores
  3. ESC

III. High Order Thinking Skills (HOTS)

Choosing Software

I. Takes time and more time

II. License agreements
- A) MECC
- B) SVE
- C) EBE

III. Get lots of software out there

Getting Teachers Involved

I. Those that preview and are involved

II. Those in the middle
- A) Administrator involvement
  1. take class for teacher (4)
  2. evaluation tool (-)
- B) Grants
- C) Parent pressure
- D) Kid pressure
  1. word spreads
  2. kids teach teachers if teacher is not threatened
- E) Inservice
  1. ESC
  2. county
  3. college classes
  4. workshops

Elementary Computer Placement

I. Permanent labs

II. Computer rooms
   A) sometimes lab
   B) sometimes computers are checked out

III. Media or resource centers

IV. Combination by computer carts

Housing Software in Media Center

A) Treated like any other AV material
B) Control for check-out and inventory
C) Greater usage due to knowledge of existence and location

THE ROLE OF THE COMPUTER IN EDUCATION VI
February 13, 1986

COMPUTER COORDINATOR SURVEY - ELEMENTARY

COORDINATOR FOR: district_____ school_____

COORDINATING TIME: full time_____ part time_____

YEARS IN EDUCATION:_____

YEARS AS A COMPUTER COORDINATOR:_____

ADDITIONAL RESPONSIBILITY (if any)_____

_____

TYPE OF COMPUTERS: Apple_____ IBM_____ Other_____

NO. OF COMPUTERS: Apple_____ IBM_____ Other_____

ANNUAL SOFTWARE BUDGET:_____

TOP FIVE PIECES OF CURRICULAR SOFTWARE USED AT:

K-3	4-6	JUNIOR HIGH
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

The following is a summary of a survey taken at the Elementary Coordinators Meeting held on February 13, 1986, at the MICRO-IDEAS Conference, **The Role of the Computer in Education VI**:

1. The average coordinators present were district coordinators.

2. The average coordinating time was on a part time basis.

3. The average years in education was 15.

4. The average years as a computer coordinator was 3.

5. The average type of computers in use:

   Apple - 55 IBM - 0 Other - 1

6. Average annual software budget - $5611.00.

7. Top six pieces of curricular software in use:

K-3	4-6	Junior High
Stickybear software	Bank Street Writer	Bank Street Writer
Magic Slate	Logo	Applewriter
Logo	PAWS	Appleworks
PAWS	Print Shop	PAWS
Reader Rabbit	Magic Slate	Newsroom
MECC-Early Addition	The Factory	Logo

WRITING IN THE K-8 CURRICULUM

By: James Hoffmann, Des Plaines School District #62, Des Plaines, IL

A copy of the Des Plaines District 62 Computer Literacy Guide scope & sequence and minimum objectives was distributed to participants for them to take. Copies of the actual grade level Computer Literacy Guides were passed around for perusal. These grade level guides contain a scope and sequence for the entire district, a minimum objective sheet for that particular grade level (showing the areas to be covered and the objectives), and a section for each area to be covered. There are thirteen computer literacy areas as per the included scope and sequence chart. The junior high guides we further divided into subject area.

Each section contains teacher background material, activities or activity sheets for students and optional material (when possible). It was the intent of the computer department to include as much material in the guide as possible so that it would become a working guide for the teacher, not just a list of objectives. Much of the material was pulled from TIES Computer Literacy Kits. Much of this is now available from MECC and/or other sources. If a disk was used that came from the MECC or public domain source, copies of the disks were included in the guide. If a disk, filmstrip, other AV material, or book was referenced as a source, then a copy of the library catalog card was included for easy reference.

The guides were tested last school year and then adopted and put into full use this 1985-86 school year. Each quarter a progress report is turned in to the principal. Along with showing what objectives the teacher has covered, there is room for successes and problems which will help the department fine tune the guides in the future.

KEYBOARDING

K-2 students use Kinder Keys from the TIES collection to begin to identify where letters and numbers are on the keyboard. MECC's The Friendly Computer is also used as optional material. Kindergarten materials also include a coloring alphabet book which matches the pictures coming up on Kinder Keys. First graders work on coloring sheets of the keyboard. Second graders have a bank of keyboard activity sheets where half rows of the keyboard must be filled in or certain keys colored in with the help of a color key. The objective in these grades is to decrease the "hunt" of the hunt and peck method.

Students in grades 3-6 use South Western Publishing's MicroType, The Wonderful World of Paws as the main source of teaching keyboarding. Mastertype is also available but caution must be taken with both these programs that the teacher is watching that students do not revert to one or two finger typing. At the junior high level, South Western Publishing's Alphabetic Keyboarding is used to maintain and build upon the skills developed in the elementary schools. Since we are jumping into the curriculum in the middle, the junior high will be teaching keyboarding from scratch for several years.

WORD PROCESSING

Bank Street Writer (BSW) is used as the standard word processor in the district. BSW was chosen for two main reasons. It is supported by many activity files, and it works on any Apple (II+, IIe, IIc) and any monitor.

Word processing is taught at grades 4-6 through subject area activities. Some activities were from the TIES collection and others from Scholastic. The important points are to not give a blank screen and say, "let's write" and to use subject matter material so that word processing is taught almost as a by-product of teaching the regular curriculum.

Junior high should use BSW for projects and papers. Again as with keyboarding, jumping in the middle means junior high teachers need to teach BSW from scratch for a few years.

WRITING

BSW is one word processor of many which can be used. Others, like Appleworks, Magic Slate, MECC Writer, etc., can also be used. However, one must be careful of the right equipment needs. Many other programs can be used even at lower grades to stimulate writing and the writing process. Word processing is only one facet of the whole process of teaching writing. Some other worthwhile programs are:

Story Maker - Scholastic
Bank Street Story Book - Pixelworks
Story Machine - Spinnaker
Writing Adventure - DLM
Sensible Speller - Sensible Software
Sensible Grammar - Sensible Software
Writer's Helper - Conduit
Ghostwriter - MECC

The list goes on and can't be completed here. It also continues to grow as more writing directed software comes on the market. Writing is one of the most important uses of the computer in education.

SCHOOL DISTRICT 62
COMMITTED TO QUALITY

COMPUTER SCIENCE DEPARTMENT

CURRICULUM SCOPE AND SEQUENCE

I = Introduce
F = Focus
M = Maintain
O = Optional

	K	1	2	3	4	5	6	7	8
Run Prepared Software	F	F	F	F	F	F	F	F	F
Computer History								F	
Computer Careers		I	F	F	M	M	M		
Computer Uses				I	F	F	F		M
Computer Terms		I	F	F	F	M	M		
Computer Components	I	F	M	M					
Impact on Society		F	M					F	
Keyboarding	I	F	F	F	F	F	F	M	M
Word Processing					I	F	F	F	F
BASIC								F	F
LOGO				0	0	0	0		
DATA BASE						0	0		
FLOW CHARTING							0		

LEARNING IN THE INFORMATION AGE

By: Beverly Hunter, Targeted Learning Corporation, Amissville, VA
Mary S. Furlong, University of San Francisco

For the past twenty years, I have been intensely interested in the implications of the Information Revolution on learning and teaching and on the nature of education. The following is a brief sifting-out of key characteristics of learning in the Information Age, and examples of some ways in which our computer-based learning activities of today are targeted towards meeting learning needs for the Information Age.

The themes I want to share are:

- Lifelong learning
- Self-Learning
- Collaborative learning
- Knowledge-creative learning

GROWING UP IN THE CLASS OF 2001

Let's assume a child of the class of 2001 is to survive and thrive in the Information Age. What kind of learning will this child need, and under what conditions?

This child is growing up during a time of explosion in information. Between 6,000 and 7,000 scientific articles are written EACH DAY. Scientific and technical information now DOUBLES every 5.5 years. But because of new and more powerful information systems, and increasing machine intelligence, the rate of doubling will soon be 20 MONTHS. There are now some 3,000 online data bases, and the number is growing rapidly. And as we all know, we are experiencing major restructuring of our economy and jobs, such that 90 percent of the new jobs created in the 1970's were in information, knowledge, or service jobs.

LIFELONG LEARNING

One implication of all this change, is that of the absolute requirement for Lifelong learning. All of us are continuing our education throughout our lives. By the 1990's the AVERAGE person will be changing careers 4 times in his or her life.

SELF-LEARNING

One of the most important things children need to learn, therefore, is how to learn. They must develop confidence in their ability to learn new subjects, and learn to take for granted the fact that they will be learning all their lives. They learn to take charge of their own learning.

COLLABORATIVE LEARNING

Another aspect of learning is the social interaction. This is important for several reasons. In the Information Age, a very high proportion of our work is collaborative. Students need to learn to communicate and share ideas and information.

The image of a classroom with one computer for each student represents a common industry-perpetuated myth about computers and the school of the future--the one-computer-one-child scenario. Of course, there are times when you do need to work alone. But interaction in large groups, and small groups, and partners--is essential for developing those collaborative skills.

KNOWLEDGE-CREATIVE LEARNING

One of the most profound and fundamental differences between learning in the industrial age and learning in the information age is "Knowledge-creative learning," which is the phrase used by one of my favorite writers on the subject of the information society, Yoneji Masuda.

The learning and teaching paradigm for the industrial age, assumed that learning is a matter of transferring knowledge and information and ideas from the teacher to the learner. This will be replaced by a paradigm which assumes the learner to be creating knowledge while he is learning. This idea is integral to the concepts of lifelong learning, self-learning and collaborative learning we've been discussing.

Some aspects of knowledge-creative learning are illustrated in some of the work my colleague, Mary Furlong at the University of San Francisco, and I have been doing with data bases in social studies. You may recall the inquiry movement in the new social studies twenty years ago emphasized information-handling skills. Hilda Taba and her contemporaries argued that children should learn how to organize and share information and to test hypotheses in the social studies. Nevertheless, the social studies classroom is still primarily textbook oriented. There is little attention to the development of systematic modes of inquiry and reasoning, including valuing. Most often students are asked to respect understanding that came from others, supposedly validated, but by processes that were not explicated, much less brought into the classroom discourse to be applied by students. There are many reasons for this, but one is the sheer practical difficulty of providing opportunities for real inquiry in a classroom setting.

DATA BASES

We now have powerful software tools, such as data base software, to help in teaching these inquiry skills. The program is used to store, organize, and retrieve information from data files on any subject from fish to zoos to populations to student grades. One example is a file Mary Furlong and I built on the subject of elections. Using data from primary sources, such as the Statistical Abstracts of the U.S., we created a data base that contains the results for every U.S. presidential election year.

You can see how much information the student has access to in a data file. Compare this with a typical government textbook where ten years of data are provided. But the real power for knowledge--creative learning is not so much in the **amount** of data the students can access. Rather it is in their ability to **manipulate** the data, to use it for inquiry. The questions and way of looking at the data are endless. Compare the electoral vote results to the popular vote results for a sample of presidential elections. Has a candidate ever received less than 50 percent of the popular vote, but still won the election? Are there historical trends in the relationship of popular to electoral votes?

Students learn how to select the particular data they need for a given question or problem, and how to have the program print out the data in a manner organized to help them see the trends and relationships.

Reflecting on the important social studies skill of citizen participation, you can see how the file would be useful for students in a government class working on an election campaign. Who should they target their campaign efforts toward? Who are the persons most likely to vote? If you saw this data and you had limited time to persuade people, who would you spend time persuading?

The data on congressional election results show both the presidential election year and the next off-year election. Students use these data to look for trends and relationships. For example, do the democrats win or lose seats in congress in the off-year election when the president is a democrat? Or, compare the voter participation in off-year versus presidential election years.

We teach the students that there are a variety of ways to present their results after testing a hypothesis and investigating a problem. It is important to learn how to organize your results and share your findings. One way is with a graphing program, such as PFS Graph.

BUILDING FILES

The possibilities for inquiry are truly endless with a data file. But our data is not always provided to us in tidy files. Students also help to create and build files.

In an example, students are doing library research to gather information to help build a file on the Constitutional Convention. We provide a file template containing a form for each delegate to the Constitutional Convention. Each student chooses a delegate to role play in a simulation of the Constitutional Convention. They do the research needed to find out the biographical background on their delegate.

We provide hard-to-find data such as the population of Virginia during the time period of the Constitutional Convention, and the slave population. But some of the data items are still blank. Students will decide on the goals for their delegation and will fill in their votes as issues are raised during the mock convention.

As votes are taken during the simulation, the students record them on the computer. They use this information for several purposes throughout the simulation. After the simulation they use the data to analyze what happened. For example, they look at the relationship between population of state and how they voted on the Virginia plan. This is another example of knowledge--creative learning.

CREATIVE TEACHING AND ACTIVE LEARNING

When students are involved in knowledge--creative learning, the teacher takes the risks. You can never be sure of outcomes. Often the data enable students to question established "truths". Students may interpret data in ways we never thought of, or in ways that contradict our own beliefs.

FUTURE DIRECTIONS

This kind of data base activity is just a small step in the direction of supporting the learning needed for the Information Age.

One next step is to include visual, pictorial data in the files, with programs like **FileVision** on the Macintosh. Another is to have much larger data files with the use of new storage devices like compact laser disk. Another is the use of telecommunication networks to share information. The technology is creating a global information space--space connected by information networks. Masuda says, "When global information space is formed, world-wide communications activities among citizens that cross all national boundaries will be set in motion, and as mutual exchanges of information expand, so will mutual understanding deepen, touching problems that lie outside the boundaries of nations and states, making it possible to deal with these problems from the global standpoint. This is the world of the child of the Information Age."

[1] Masuda, Yoneji. The Information Society as Post-Industrial Society. World Future Society, 1980.

[2] Furlong, Mary and Hunter, Beverly. Scholastic U.S. Government Data Bases. Scholastic, Inc. 1985.

PFS IN THE MEDIA CENTER - SOME PRACTICAL EXAMPLES

By: Paul Icenogle, Conant High School. Hoffman Estates, IL

I. INTRODUCTION--When should I use a computer? Brainstorm based on these reasons:

A. If it is to be typed more than once.

B. If there is a good chance of making mistakes.

C. If it needs to be updated.

D. If it is to be alphabetized or put into numerical order.

E. If it requires some special printing technique.

F. If you are going to use the same material in more than one arrangement.

II. MAJOR TYPES OF COMMERCIAL COMPUTER PROGRAMS:

A. Data Base

B. Report Management

C. Word Processing

D. Spreadsheet

E. Graphics

F. Integrated--Combines two or more of the above

III. HOW DO I DECIDE ON ONE OF THESE PROGRAMS?

A. What type of formats do they offer?

B. Can they print labels and lists?

C. Are they easy to use?

D. Can they do form letters?

IV. WHY I DO MORE ON PFS THAN ON APPLEWORKS

PFS	APPLEWORKS
Double line entries	No double lines
Simple spreadsheet	Not as easy as PFS
Form letters easy	Need Mail Merge as well
Many fields on data base	Forty fields on data base
Fields can have long entries	Fields are limited in size
FILE and PLAN merge easily	DB & spreadsheet merge tougher
Manuals are easy to follow	Instruction book format
PFS: File is slow	APPLEWORKS SORTS QUICKLY

V. REAL LIFE EXAMPLES OF PFS IN ACTION

A. Development of a film rental ordering and notification system for a high school. 30 persons order approximately 300 films from 25 vendors.

1. What do you need?

a. Lists for: (with various combinations of data)

(1) Teacher
(2) Administration Office
(3) Department chairmen
(4) Rental Source
(5) Weekly check in and out for media center.
(6) Purchase information for teacher each spring to make decisions for next year's ordering.

b. Personalized notices for teachers on arrival of film.

2. What kinds of data are necessary?

a. Title	d. Play date	g. Week #	j. Length
b. Status	e. Source	h. Film #	k. Reason
c. Teacher	f. Department	i. Price	

3. Design the file.

a. Prefix (PRODOS ONLY)
b. File name
c. Design form

(1) Most often searched in upper left.
(2) Leave space for double lines.
(3) Plan indicators of line length on reports.

4. Add the information.

5. Print reports.

6. Combine with PFS:Write.

B. Other PFS ideas

1. Equipment inventory.
2. Equipment labels with card file for check out.
3. Equipment clean-up checklist.
4. Software cataloging with subject area bibliographies.
5. Update cataloging of phonograph records.
6. Projection bulb use and inventory.
7. Labels for cords (patch and extension) and microphones.
8. Library statistics with PFS: Plan.
9. Purchase orders on PFS: Write (Line Length ruler).

CARE: COMPUTER ARRANGED REPORTING AND EVALUATION

By: Suzanne Isbell, Barbara McMillan, Marilyn Switzer, Carl Sandburg School, Charleston, IL

This session will describe the Mastery Management System developed by the Hopkins Public Schools in Hopkins, Minnesota, and four grade management utility programs.

The Mastery Management System is a computerized test-scoring and recording tool. The program is a generic management system which provides a framework into which users may enter their own objectives, answer keys, student names, and study helps.

Last summer we used our existing math program and identified specific objectives to be taught. Using these objectives, we developed multiple-choice test questions that tested each objective. We then determined "mastery" or "partial mastery" levels for each objective. Our objectives and their mastery and partial mastery levels, answer key information, and student data were entered into the program.

We had an introductory meeting for parents before we began the program. At that time we explained the system, including coupons and study helps with examples of each. We also gave each family a list of the numbered objectives and answered questions.

During the school year we test the objectives as we teach them and the students' responses to the tests are then entered into the computer system. The student's test is scored by a card reader attached to the computer and his level of mastery is determined. The system provides reports of both individual student and class performance on tests and objectives. Using this printout, the teachers can determine individual student progress and entire class mastery. In addition, they can group students for appropriate instruction or reteaching.

An option to this system is to enter study helps for each objective. These study helps refer to textbook pages, practice exercises, and other learning activities which are available to the student who has not mastered, or only partially mastered, an objective. We feel this is a strong advantage to this system because reteaching is done immediately with the study helps. After taking each test the student takes home a printout or "coupon" with his score and any study helps he may need. We have had excellent support from parents in helping students with study helps at home.

The equipment needed to support this program includes a computer, monitor, printer, two drives, a card reader, and software (program disk, data disk, and optional study helps disk). The card readers that can be used are HEI, Scan-Tron, Chatsworth, and True Data.

Students enjoy this program because they are involved. Parents support the program because they have frequent reporting and study helps for remediation sent home. We are opening our gradebook, so to speak, to the parents so there are no surprises at report card or conference time.

Students are tested on machine readable response cards which are scored in a card reader. Several options are available to teachers for using the card reader. The teacher may do the machine scoring herself, assist students in running their own response cards through the card reader, or train several students to use the card reader. Also they in turn can teach other students. In addition, older students, aides, or parent helpers may be trained to do this task.

We have encountered some problems with students using the response cards improperly. They have marked improper student numbers, marked improper test numbers, failed to mark the answer space dark enough, erased too heavily on the response cards, and neglected to move to a new column for a new answer. The teachers gave additional help to the students having difficulties using the response cards correctly.

The importance of correctly marking the response cards was demonstrated when each child was allowed to run his own card through the card reader to see his card being accepted or rejected. Finally, token rewards were given to students whose response cards were accepted and tokens were given up by students whose cards were rejected.

The computer prints out a home report (coupon), a student results sheet (grade book), and a test form evaluation.

The coupon shows how each student performed on the test. Each question is scored right or wrong and shows the objective related to the question. The objectives are identified as mastered, partially mastered, or not mastered. Mastery is based on criteria determined by the teacher.

The bottom of the coupon may include study helps listing materials to help the child improve performance--such as suggestions for rereading materials in the text, additional exercises found elsewhere in the text, worksheets, workbook pages, commercial or teacher-made instructional games.

The student results sheet (gradebook) lists the students, the total questions correctly answered, the students percentile score, the number of objectives mastered, partially mastered, and not mastered, by each student.

We find that each of us reteaches the material not mastered a little differently. Sometimes the individual teacher will vary the way she reteaches the unmastered material depending on her needs and circumstances. The system doesn't dictate an approach, but is simply a tool for the teacher to manage the curriculum already in place.

After student tests have been scored, numerous reports can be printed, in addition to the student coupon and the teacher gradebook. The reports that may be requested by the teacher are:

1. **The Teacher Test Form Evaluation** which shows student group performance on the test for the entire class. The teacher receives information indicating the percent of correct and incorrect responses for each question. This is a useful first indicator as to how the class as a group is performing on each objective.

2. **The Individual Student Status Report** which contains mastery information for any selected student. Any or all objectives may be included in this report. It is printed to screen or printer and tells teachers, students, and parents which objectives have been mastered by an individual student.

3. **The Group Student Status Report** which is an alternative to the individual report and gives the teacher a summary of the mastered objectives, the partially mastered objectives, and the objectives not mastered. Reading across the chart gives the mastery record for a particular student while reading down the column at a specific objective will provide mastery information for that objective. This is an efficient aid for planning. For example, reteaching can be set up for a concept missed, or a class can be regrouped for purposes of review. Teachers, students, and parents can tell at a glance which skills need further attention.

We like the labels printed by the Mastery Management System. They list the student's name, the student's I.D. number, the teacher's name, the course name, and the date. We placed these labels on the children's coat racks, mailboxes, and folders.

There are other possible uses of the Mastery Management System that may or may not be helpful to education. It can be used for statewide basic skills assessments and for minimum competency testing. Teachers can be compared to their peers on the basis of student progress with teacher remediation in mind. Merit pay can be based in part on a printout called the Course Summary Report. This report lists the names of teachers who are all teaching a section of the same course. Under each teacher's name is a column showing the percentages of their students who have mastered each objective. Teachers whose reports indicate high student mastery can act as models for teachers who make a poor showing.

GRADE MANAGEMENT SYSTEMS

The teachers in our building are using several grade management systems. Four will be summarized here.

AEN GRADING SYSTEM II

AEN prints out a list of percentage scores and an average for each student in each subject. No letter grade is assigned. The printout does not state the name of the class, but does give a short explanation of each assignment that has been given a grade. (We usually pencil in the name of the subject area at the top of the printout.)

It is possible to translate AEN files into a DIF format so that they may be used by other programs such as VisiCalc and DB Master.

Assignments may be eliminated from final score consideration for individual students. The high/low score for an individual student may be dropped. By using expanded files, as many as 70 assignments can be accepted (instead of the original 32).

This system is not difficult to use and copies may be made for use within a building so that the cost is reasonable. It can be used with one or two disk drives.

THE GREAT GRADER

The Great Grader is designed for elementary teachers. As with most grade management systems, an average for every student and for each subject can be obtained at any time. Teachers who like to see the assignments in a given subject listed side by side across a page will be disappointed, however. The Great Grader produces many very worthwhile reports, but never lists more than one assignment on a page. This is not as bad as it first seems.

The assignment page printout shows a list of the students' raw scores (as they were entered), a rank ordering by percentage and a standard score. The rank order is from the highest to the lowest followed by unexcused, excused, and missing papers. The standard deviation and class mean are also shown. There is an ample narrative section where the teacher may write assignment specifications.

The Individual Report is similar to a report card, but reports a grade average for only the subject areas chosen by the teacher. It includes a class average, a parent signature line, and a space for parent comments. The comments at our school have been positive.

It is possible to enter the same assignment grade into more than one subject area at one time. For example, while entering a reading assignment, the teacher might indicate that the grade be filed under READING and also under COMPREHENSION. The teacher might enter each grade with a separate tracking called CLASS WORK versus HOMEWORK. The program allows the teacher to enter up to one hundred unique category names. The names may be changed or deleted at any time.

MASTER GRADES

Master Grades from Midwest Software does not save individual test scores so a paper record sheet must be kept for recording grades which are then transferred to the computer. It keeps a cumulative total of points earned which is converted to letter grades. The grading scale may be designed by the teacher. A student may be excused from an assignment or listed as absent so that a make-up grade may be added later. Attendance records may be kept. A Progress Report may be printed for each student with the school name and telephone number. There is a choice of notes that will print out with the grades. There is a congratulatory note, an informational note, and an unsatisfactory note.

The maximum number of students that this program may handle is 200. If you have more than 200 students you may contact the company for suggestions on how to create more files.

Master Grades was designed for the secondary level, but can be used by elementary and college level teachers.

CLASSMATE

Classmate from Davidson and Associates, Inc., will accept a maximum of 51 student names. If you try to enter a second roster of different names, the computer warns you that you will lose all the current data in memory. (New students can be added, however.) You can create a new file for a different subject area without having to retype the names. The names are copied electronically from the existing roster.

Classmate will keep track of grades, attendance, and incomplete work. It will compute a final grade, identify students who are failing, make grade distribution graphs, and print statistical reports. Classmate will sort your roster alphabetically by last name or by ID number.

Printouts that are possible are Class Roster, Students' Records, Class Ranking, Missing Work, Class Distribution, and Weighted Averages. The Weighted Averages Printout is one that shows test scores and averages for each child. The average is converted to a letter grade. The scale for the letter grade may be determined by the teacher.

Classmate will run on an Apple IIc, Apple IIe, or an Apple II+. It can be used with either one or two disk drives.

KEYBOARDING — JUNIOR HIGH

By: Truman Jackson, State Specialist for Business Education, New Brighton, MN

Keyboarding and Word Processing for Personal Use
30 Hours--A 9th Grade Program

I. Introduction to Keyboarding

A. Word Processing and Communication Skills

B. Posture and Techniques used when working at a keyboard

C. Review vocabulary for keyboards and microcomputers

1. Monitor
2. Drive
3. Keyboard
4. Printer
5. Power Switches
6. Paper Table
7. Paper Guide
8. Paper Index and Paper Bail
9. Paper Release Lever
10. Cursor
11. Daisy Wheel
12. Program Disks
13. Data Disks
14. Backspace/Left arrow
15. Correcting Backspace/Delete Key

II. Operating the Keyboard

A. Start-Up & Closing Procedures

1. Typewriter
   a. Power ON
   b. Paper Insertion
   c. Setting of levers and switches
      (1) ribbon position
      (2) line spacing
      (3) pitch setting

2. Microcomputer
   a. Review terminology and use of:
      (1) Escape Key
      (2) Caps Lock
      (3) Open Apple
      (4) Reset
      (5) Control
      (6) Cursor
      (7) Directional Arrows

b. Handling and Care of Disks

c. Loading "booting" the program disk

d. Procedure to get to the Main Menu

e. Lesson Start-up procedures
   (1) Starting a lesson
   (2) Answering prompts

f. Closing Procedures
   (1) Exiting from an unfinished part of a lesson
   (2) Exiting from the micro

B. Alphabetic keys

C. Top Row Numeric

D. Symbols

E. Format Principles

1. Vertical and Horizontal Centering
2. Margin Setting
3. Tab Settings

III. Review and Skill Development

A. Technique and Appropriate Keystroking

B. Keyboard Skills

1. Speed Development
   a. Word/paragraph drills
   b. One and two-minute timed drills

2. Accuracy Development
   a. Word/line drills
   b. Paragraphs

IV. Introduction to Text-Editing

A. Procedures to "boot" software program

B. Creating, Saving, and Printing Text
   1. Formatting
   2. Keying of text
   3. Exiting to Main Menu
   4. Saving Text to Disk
   5. Printing hard copy of text

C. Review of Basic Editing Skills
   1. Identifying errors
   2. Use of Proof marks
   3. Correction Procedures

a. Add or insert text
b. Delete text
c. Typeover mode

4. Use of spell check program

D. Intermediate Word Processing commands:
1. Search and Replace
2. Copy and Move
3. Decimal Tabs
4. Paging of documents using headers and footers
5. Print Enhancements
a. Bold
b. Underline
c. Print Codes
(1) Expanded Mode
(2) Compressed
d. Superscripts

V. Applications

A. Paragraph Typing
B. Short Report
C. Personal Business Letters
D. Centering Problems/Display Materials
E. Outlines
F. Open Tables
G. Minutes of Meetings
H. Composition Exercises
1. Paragraphs
2. Reports
3. Letter--Personal Business

VI. Evaluation

A. Appropriate finger and technique checklist
1. Posture
2. Keystroking
3. Spacing
4. Shift Key Operation
5. Return
6. Function Keys
7. Start-Up and Closing Procedures
8. Disk Handling

B. Reports of Speed and Accuracy

C. Quizzes on use of software and the unit of instruction principles

D. Unit Grades--Point Scale

1. One to five points per page.
All typographical errors found by the teacher are graded as one point on the page.

2. Students must have 75 percent of the total unit points to receive a passing grade on the unit of instruction.

E. Final Exam

1. Two pages of questions relating to the units of instruction, equipment and software used.

2. Application Problems
   Centering Problem
   Personal Business Letter
   Report
   Outline

VI. Materials and Software

A. Microtype, The Wonderful World of Paws

B. District developed Micro-keyboarding Book containing drill and practice material selected from Century 21 Typewriting, Book 1 correlated with presentation of keys on Microtype disks.

C. Teacher developed drill and practice worksheets to supplement keyboarding practice book.

D. Teacher developed units of instruction for learning PFS software program with application problems selected from various typing, word processing, communications publications of various publishers.

E. Teacher prepared data disks for editing skills.

F. Teacher developed worksheet and applications problems from sources listed in No. 3 above and also working jointly with teachers in other departments--show students the transference of learning of skills.

G. Keyboarding drill books and textbooks borrowed from the high school.

MICROCOMPUTER: SOMETHING FOR EVERYONE

By: Judith E. Jacobs, George Mason University, Fairfax, VA

For the past three years I have spent a considerable amount of my professional life exploring the promises of microcomputers and how they can, and should impact on the educational system. I have thought about how microcomputers can affect what we teach, how we teach it, and how children learn. I also have wondered about how microcomputers can and should change the ways in which teachers do their "non-delivery" of instruction tasks. And, as I attempted to formulate a plan for using microcomputers in the school, I asked myself who is going to be responsible for using microcomputers to accomplish all the things that they can do? The more I thought, the more questions I had. I will share with you my conclusions about some of these things.

This paper is concerned with the instructional program in the schools, most particularly elementary and middle/junior high schools, and how microcomputers can enhance that program. It also addresses who can or should do which particular tasks in using microcomputers for instruction.

Henry Jay Becker of Johns Hopkins University has conducted two large surveys of how microcomputers are being used in the schools. The results of the second survey are beginning to be reported. Becker (1985) presents the following data on the uses of computers.

PER CENT OF ALL USERS BY USE

USE	ELEM	MIDDLE/JHS	SHS
CAI	61	36	19
PROG*	10	28	48
DISC/PS	19	15	9
WP	7	11	19

*Programming includes computer literacy activities at the senior high school level.

CAI stands for computer assisted instruction and represents the use of computers to teach or reinforce the traditional curricula. The data indicates that as the students get older there is a dramatic decrease in the use of these types of programs. On the other hand, there is a substantial increase in the per cent of time spent on learning programming and other computer literacy activities as the age of students increases. Discovery and problem solving activities are more prevalent at the elementary school level, but to a lesser degree than are other CAI uses. Word processing is beginning to be used at all levels.

Those are the ways that microcomputers are currently being used in schools. Another way of examining the uses of computers is Taylor's (1980) model of tutor, tool, or tutee which I have reworded as Object Of Study (tutee), Tool, and Aid to Instruction (tutor). I have also identified three implementers of the instructional component of microcomputer's impact on the schools. They

are: the classroom teacher, the computer educator (a specialist assigned just to computer education tasks), and the librarian or media specialist. While looking at these uses of the microcomputer, I will also suggest who should be responsible for, or assist in, conducting these activities.

OBJECT OF STUDY

If the microcomputer is to become part of the curriculum, something that is studied, then there are three topics that need to be addressed. They are hardware, how computers work, and programming. Additional topics could include the history of computers and how they are used in society. The most time consuming part of this curriculum is programming.

Programming involves the learning of both language skills and problem solving skills. The language skills that must be mastered are knowing a specific vocabulary (LET, PRINT, FOR-NEXT or RIGHT, MAKE), applying syntax rules (LET A = 2*a works; LET 2*A = does not.), understanding of error messages (FOR WITHOUT NEXT, RT NEEDS MORE INPUT), and proofreading (for debugging). The problem solving skills follow the Polya's heuristics of mathematical problem solving. First one must understand the problem and then plan a solution. This is the flowcharting stage of programming. Next, in mathematics, one writes the equation. This is analogous to coding the solution. Then the solution is checked, or the program is run. Finally, if needed or desired, the plan is revised; and that is what debugging is about.

A key question, if one decides to teach programming, is "What language should we teach?" At the elementary and middle/junior high school level, the choice is usually between BASIC and Logo. Each language has its proponents and detractors. Logo is very popular because of the ease with which teachers and children quickly can master the simple commands of Turtle Geometry (FORWARD, BACK, LEFT, AND RIGHT) and make involved pictures from often poorly written programs or procedures. Turtle Geometry explores the turtle's world of 360 degrees. It has been discovered, though, that mastery of the list processing components of Logo is not easy, for both teachers and students, to learn. BASIC is a highly algebraic language. The syntax of BASIC parallels the syntax of mathematics and is ideal for use in solving consumer mathematics problems. Again, as with Logo, the ways of handling words is not as easy to learn.

Which language should be used? If I ruled the world and if I had to teach programming, I would use Logo in grades kindergarten through three or four, focusing on Turtle Geometry only. In grades four or five through nine, I would teach BASIC. But only if I had to teach programming. And if I did, I would not have every classroom teacher teach programming. Classroom teachers are already overworked. Elementary school teachers are expected to know the content of all subject areas as well as how to teach these content areas. If the microcomputer as an object of study is to become part of the curriculum, if programming is to be taught, then there needs to be a computer educator who should teach this part of the curriculum. All teachers are not expected to teach instrumental music or a foreign language; they should not be expected to teach a computer language.

TOOL

The microcomputer can be a valuable tool that supports instruction in the traditional curricula of the schools. Becker (1985) reports that in the past 2 years the per cent of computer-using educators who have identified the tool uses of microcomputers as the most effective use of microcomputers has increased from 10% of those surveyed to 30% of those surveyed. I have identified five tool uses of microcomputers that support the instructional program. Word processing, databases and electronic spreadsheets are application software packages that are the primary uses of microcomputers in the business world. Each accomplish general tasks that will be described below. Utility programs are more specific in focus. They are used to prepare materials for instruction or focus on certain aspects of instruction.

The least used tool use of microcomputers is as a device for demonstrating ideas and concepts that students are expected to learn. Like the overhead projector, the microcomputer can be used to help the teacher present ideas in more interesting and more understandable ways than can "chalk and talk." Microcomputers are a valuable tool in presenting semi-concrete learning experiences to children who are in Piaget's concrete learning stage or are just beginning to operate at a formal operational stage.

Before describing in detail each of these tool uses of microcomputers, let me address who will be responsible for their use. Considerable time is needed for teachers to learn all these software programs. Some require more time than others, but all require less time than it would take to become programmers of sufficient skill to be able to teach programming. The computer educator should be responsible for teaching the children and teachers how to use these programs. This means that when the students go to the computer laboratory or are taught by the computer educator. the classroom teacher does not have a free period. Probably there will be a need for a special session for the teachers, but the general introduction for teachers can occur when the children are first introduced to the programs. The classroom teachers will need to work with the programs on their own. They will be responsible for using these programs in the classroom as part of the regular curriculum. These application programs will be used when teaching language arts. science, and other subjects. Application programs are resources used by students to complete assignments given in class. The librarians or media specialists needs to know these programs, for they should be available for use by students in the library or media center and these individuals may need to help students when they are using these programs.

WORD PROCESSING

Word processing enables the writer to separate the content of what is written from its form. Text is entered without concern for how it will look on the page. Decisions regarding the printed form. or hard copy, are made after the text, or content, has been determined. Word processing supports writing in all subject areas. It can be used to teach the specifics of grammar as well as enhance the entire writing program.

DATABASES

Databases are collections of index cards, each of which has information about a topic on it. Database programs provide means for shuffling these cards so that the cards with particular information on them can be found. Each card is called a <u>record</u> and the specific category of information is called a <u>field</u>.

Data is entered for each field on each record. The data is then sorted and reports are prepared, giving the information wanted. For example, a database on presidents (the topic) would include a record for each president. The fields for each record could include name, political party, date of birth, and date of inauguration. A report might be a listing of all Republican presidents who were inaugurated in the 1800's.

Databases are modifiable. They can be changed by adding new fields, new records, or by up-dating the previously entered data. Most importantly, databases support all curriculum areas. There are commercially available databases for specific programs on the states, topics in the life sciences, and music trivia. Teachers and students can create databases on any topic and much is learned about microcomputers and the subject being studied in this process. A database on books read by classmates can motivate students to read what their friends have read. A caution though, you may find your students will select books by the number of pages in the book so that they can read the shortest books on the list. A database on geometric shapes can help students discover common properties of parallelograms. The number and types of databases are only limited by our imaginations.

ELECTRONIC SPREADSHEETS

Electronic spreadsheets are computerized versions of accountants' spreadsheets. They are organized into rectangles comprised of rows and columns. Data, usually numbers, are entered into a cell, the intersection of a row and column. Calculations can be performed on these data. Spreadsheets are used primarily in science and mathematics. In science, the data on planets or the growth records of different plants could be entered. In mathematics, budgets could be created or the measurements of the sides of geometric figures could be entered. The power of electronic spreadsheets is that the changing of one piece of data will result, when the proper command is given, in the recalculation of all entries using that datum. It makes the chore of predicting "what would happen if I doubled..." possible. This powerful use of electronic spreadsheets requires the ability to do hypothetical thinking. This limits its use to grade six at the earliest and, more likely, makes it appropriate for use with students in grades eight and above.

UTILITY PROGRAMS

Utility programs are used to support instruction by helping students and teachers focus on the content that is to be learned. The Print Shop is but one example of this type of program. Using The Print Shop, one can design posters, cards, and banners. In addition to the writing skills used in composing these items, students can develop their art skills as they design the layout of the cards and posters. One class of the secondary school learning disabled youngsters used The Print Shop as the basis for a more involved project. They went into the business of selling the cards, signs, and banners they made. They used their skills in mathematics (calculating costs), language arts and writing, and business (taking orders by completing a standard form). They also practiced their interpersonal skills as they dealt with their customers.

Another example of a utility program is Puzzles and Posters. This package from MECC enables teachers and students to make crossword puzzles and word searches. The vocabulary is selected by the user. It helps students learn the vocabulary of any subject. A very different kind of utility program is

The Semantic Calculator. This program is designed to assist mathematics and science teachers teach problem solving by forcing students to separate the number used in a problem from its units. If the length of a rectangle is 4 centimeters, then the "4" and the "centimeter" are isolated and treated individually. Analysis is done by looking at the effect of mathematical operations on the units. The Semantic Calculator helps students focus on the operation undertaken and the units of the answer. It is a boon to teaching problem solving.

DEMONSTRATION

The use of the microcomputer as a device for teacher demonstration holds considerable promise. Computer demonstrations can make ideas and relationships less abstract. Relatively simple programs can be written that demonstrate change. Unlike transparencies for the overhead projector, such demonstrations are non-static; the change can be viewed as it occurs. A good demonstration should allow for variable input, allowing the students to view different representations or occurrences of the concept or idea demonstrated.

Demonstrations can be prepared in many subject areas. In social studies, there can be a map of the United States which shows, using colors, which states have Democrats or Republicans as governors or which states had an increase or decrease in population. In mathematics, a simple rectangle can be divided into fractional parts and shading can be used to show multiplication of fractions. In science, an inclined plane can be shown with an object rolling down faster as the angle of the plane increases. Though considerable programming skills are needed to write such programs, the level of complexity and difficulty in their design and coding is no where what is needed to write traditional CAI programs.

AID TO INSTRUCTION

As Becker's (1985) data showed, computer assisted instruction is the most prevalent use of microcomputers at the elementary and middle/junior high school level. Computer assisted instruction is available in all curriculum areas and in either traditional lesson formats or as educational games. A recent study by Education Turnkey Systems, Inc. (1985) found that CAI was as effective as traditional instruction in 55% of the studies examined, and was more effective in the other 45% of the studies.

CAI programs are usually classified into one of three types. Drill and practice programs comprise the majority of the CAI programs available and often are cited as a poor use of computer time. Practice is an essential part of the learning process. These programs provided students with the chance to practice particular skills, over and over again. These programs make a contribution to the educational process. A question is asked or a task is set. The user is expected to provide an answer, often within a specific time period. Most of the time the user is informed immediately whether he or she is correct or not; sometimes there only is a final report on how the user did.

Though there are drill and practice programs of questionable quality on the market, there are also some excellent ones available. Maze-O, produced by D. C. Heath, is an example of a good drill and practice program. Teachers, students, or parents can enter their own spelling words into the program or use the graded list of spelling words available as part of the program. The

program "remembers" the user's errors so that they can be retested on missed words. Alligator Mix, by DLM, is an example of a drill and practice program that lets the teacher set the speed of response required, the level of the activity, as well as the duration of a practice session. Both of these programs let the teacher change the parameters for the program. This results in a more individualized approach to learning than with software in which everyone practices whatever is randomly assigned by the program.

Tutorials differ from drill and practice programs in that they provided instruction, rather than just ask questions and assess progress. The user is presented with new material and then is asked a question or given a task. Based on the response, the user is "sent" to the appropriate section of the program to continue learning. More material is presented, more questions are asked and more instruction takes place. A good tutorial program includes many branches. Instruction is individualized and students are able to proceed at their individual rates. Mathematics with Base 10 Blocks, by the Cuisenaire Company of America, Inc., is an example of a good tutorial. The content in the lesson is divided into small steps to provide for most learners. A weakness of the program is that it is primarily linear, that is, there is very little branching so that most learners go through the identical instructional sequence.

Simulations are the third type of software usually used for CAI. Simulations usually involve a model of real life in which real events are portrayed. One feature of simulations is the compression of years into minutes or seconds. The purpose of simulations is to enable students to test hypotheses without worrying about the actual consequences of their decisions. Annam, by Educational Activities, Inc., allows the user to rule a southeast Asian country and decide whether to send troops off to war or not. Oregon Trail, by MECC, allows students to make the trip to Oregon and experience making the life or death decisions that the pioneers had to make. Cat Lab lets students see the effects of genetics on the breeding of cats without having to wait for the kittens to be born or the worry of what to do with the kittens.

Problem solving software is often included among simulation software. These programs are less concerned with real life events than are other simulations. They often create a fantasy world in which users have the chance to play games or solve problems in ways that enhance their problem solving skills. Moptown, by the Learning Company, creates creatures that differ by size, shape, and color. Determining which creature belongs or does not belong allows users to develop their discrimination skills as they attend to different attributes.

CAI is the province of the classroom teacher. These programs assist in the teaching and learning of the traditional curriculum. Though the computer educator may recommend new programs and the librarian or media specialist may be responsible for cataloging this software or making it available to the students for their use it is the classroom teacher who needs to know what software can be used to enhance the traditional curriculum and when it can best be used.

With all the CAI software that is available, decisions need to be made as to which type to buy. Drill and practice software can aid the teacher by providing students with an entertaining way of practicing skills. At the same time, the teacher is freed from making practice sheets and is available to work with students. Simulations are difficult to create in the classroom. In

fact, some simulations are impossible to do without a computer. Therefore, drill and practice and simulation software are worthwhile purchases. Teachers were hired to teach. It is what they do best. Given the quality of the tutorials available, I would spend little money on this kind of software.

The title of this paper is "Microcomputers: Something for Everyone." Computers can and will change what we do in the classrooms. There are roles for all of us, classroom teachers, computer educators, and the librarians or media specialists in this coming revolution. That "everyone" in the title also should be inclusive for students. Research (Muira & Hess, 1984; Anderson, Welch, & Harris, 1984) indicates that females and minority students are under-represented in computer activities and courses. If microcomputers are to play a major role in the educational system of the future, it is up to all of us to assure that every student has an equal chance to become computer literate. Working together we can make the tasks before us manageable by supporting each other's efforts, rather than duplicating them. It is a challenge, but one that excites me and I hope you.

REFERENCES

1. Anderson, R. E., Welch, W. W., & Harris, L.J.. Inequities in opportunities for computer literacy. The Computing Teacher, 11(8), April 1984, 10 - 12.

2. Becker, H. J.. The Second National Survey of the Instructional Uses of School Computers. Baltimore, MD: The Johns Hopkins University, 1985. Reported in School Tech News, 3(2), October 1985, 1.

3. Education Turnkey Systems, Inc. Uses of Computers in Education. Reported in School Tech News, 3(1), September, 1985, 1.

4. Miura, I. T. & Hess, R. D. Enrollment differences in computer camps and summer classes. The Computing Teacher, 11(8), 22.

5. Taylor, R. P. (ED.). The Computer in the School: Tutor, Tool, Tutee. NY: Teachers College Press, 1980.

THE SPREADSHEET - EXCEL

By: Bernard J. Kelly, Forest View High School, Arlington Hts., IL

What is an electronic spreadsheet? How can it be useful to Educational Administrators? Using a spreadsheet allows one to work with numbers in rows and columns to perform various calculations, apply formulas and to manipulate numbers in a simple manner. With the spreadsheet, numbers can be changed and the effects of these changes can immediately be seen. For educators, a spreadsheet dealing with projections may be one of its most valuable uses. Using the history of the school with respect to the total enrollment, the percent of students in each subject area and the projected enrollment for the next year, an administrator can predict the number of students that will enroll in all subjects and the number of teachers needed for each subject area. The reliability of these projections will be dependent upon the accuracy and reliability of the statistics gathered for the "history" as the following example shows.

	A	B	C	D	E	F	G	H
1	School :	XXX		Staffing Worksheet 1985/86				
2	Build Enroll :	2150						
3								
4		Art	Eng	F. Lan	Math	P E	Sci	Soc. St
5								
6	Act Crs Enrol	253	2307	1112	1861	2185	1527	1486
7	% Enroll	11.77%	107.30%	51.72%	86.56%	101.63%	71.02%	69.12%
8	# Classes	11	109	49	79	66	67	58
9	Ave Class	23.00	21.17	22.69	23.56	33.11	22.79	25.62
10	FTE Teachers	2.2	21.8	9.8	15.8	13.2	13.4	11.6
11								
12								
13								
14	Est Build Enrl	2000						
15								
16	Est Crs Enrol	235	2146	1034	1731	2033	1420	1382
17	# Classes	10	101	46	73	61	62	54
18	Est FTE	2.0	20.3	9.1	14.7	12.3	12.5	10.8

FIGURE 1

Other important uses for the spreadsheet for educators deal with the normal business types of problems, budgeting, accounting, purchase orders and a variety of applications dealing with numbers. A spreadsheet can also be used as a limited type of data base. The next question to be answered is--what spreadsheet should be used for educational problems?

The choice of a spreadsheet depends on many factors and may be completely different for each school or district. The spreadsheet that is to be used will be dependent upon the type of hardware being used or to be purchased. And even for one particular brand of hardware, there are several different spreadsheets that will be able to be used. All spreadsheets are basically the same in what they are intended to do, that is to manipulate numbers through basic operations and formulas. The difference is in the ease of use, the speed of changes, the size of the spreadsheet, and the complexity of the formulas and the relationships that can be created within the spreadsheet and between several spreadsheets.

Excel, a spreadsheet developed by Microsoft and used on the Apple Macintosh Computer, is one that can be used in education for administrative applications. It is not the only spreadsheet nor is it one that is being recommended. This presentation is only a demonstration of the Excel program illustrating its strengths and differences between other spreadsheets.

One of the most impressive features of the Excel spreadsheet is its recalculation speed. In most spreadsheets, once a value is changed, all cells in the spreadsheet are recalculated. If the spreadsheet is long this may take some time to perform these recalculations thus slowing down the entire process. Excel, however, recalculates only those cells involved in the change. This may be the spreadsheet that is present in memory and is referenced by this first spreadsheet.

Another feature that makes Excel a very impressive and useful spreadsheet is the ability to reference several other spreadsheets at the same time. For example, cell D3 in spreadsheet "School All" may be the sum of cell D3 of spreadsheet "School A" and cell D3 of spreadsheet "School B." If the values in any of these referenced cells are changed, cell D3 of spreadsheet "School All" will be immediately changed.

	A	B	C	D
1		School All		
2		Supplies		
3	1	Paper	12.5	='School A'!$D$3+'School B'!$D$3
4	2	Pencils	3.75	='School A'!$D$4+'School B'!$D$4
5	3	Staples	6.45	='School A'!$D$5+'School B'!$D$5
6				
7				
8				
9			School A	
10		Paper	='School A'!$E$3+'Schoo	
11		Pencil	='School A'!$E$4+'Schoo	

FIGURE 2

Formulas used in spreadsheets are very important and vary in number and type from spreadsheet to spreadsheet. Excel has 84 different formulas that can be used in any cell of the spreadsheet. The series command is also very impressive. By typing in a date, such as Feb-86 and "drag and highlight", the series command under the Data Option, a series of dates can be placed into several cells--that is, the next cells would be Mar-86, Apr-86, May-86 and so on. The series command can be initialized on days, months, or years. It can also be used to start a series of numbers with any starting point and increment.

	A	B	C	D	E	F	G	H
1	Date	Jan-86	Feb-86	Mar-86	Apr-86	May-86		
2								
3	Date	1/5/96	1/6/96	1/7/96	1/8/96			
4								
5	Date	1/6/86	1/7/86	1/8/86	1/9/86	1/10/86	1/13/86	1/14/86

FIGURE 3

Formulas can also be built for a particular cell either by referencing other cells or using names that reference certain cells. That is, cell B3 could be =A3*A5 or it could=Prin *Rate where Prin is the name of cell A3 and Rate is the name of cell A5.

	A	B	C
1		Sample 1	Sample 2
2	Prin		
3	$5,000.00	$850.00	$850.00
4	Rate		
5	17%		

FIGURE 4

	A	B	C
1		Sample 1	Sample 2
2	Prin		
3	5000	=A3*A5	=Prin*Rate
4	Rate		
5	0.17		

Various types of prints, fonts and sizes are available in the Excel spreadsheet.

	A	B	C	D	E	F	G	H	I
1		School A					Departments		
2		Supplies			Math/Sci		Lang/Fine Arts		SS/For. Lang
3	1	*Paper*	$12.50	2	$25.00	3	$37.50	4	$50.00
4	2	*Pencils*	$3.75	4	$15.00	4	$15.00	2	$30.00
5	3	*Staples*	$6.45	1	$6.45	1	$6.45	5	$32.25
6									
7					$46.45		$58.95		$112.25
8									
9									

FIGURE 5

	A	B	C	D	E	F	G	H	I
1		School A					Departments		
2		Supplies			Math/Sci		Lang/Fine Arts		SS/For. Lang
3	1	Paper	$12.50	2	$25.00	3	$37.50	4	$50.00
4	2	Pencils	$3.75	4	$15.00	4	$15.00	2	$30.00
5	3	Staples	$6.45	1	$6.45	1	$6.45	5	$32.25
6									
7					$46.45		$58.95		$112.25

Graphs can be created with Excel quickly and easily by just highlighting the portion to be graphed and choosing the type of graph desired.

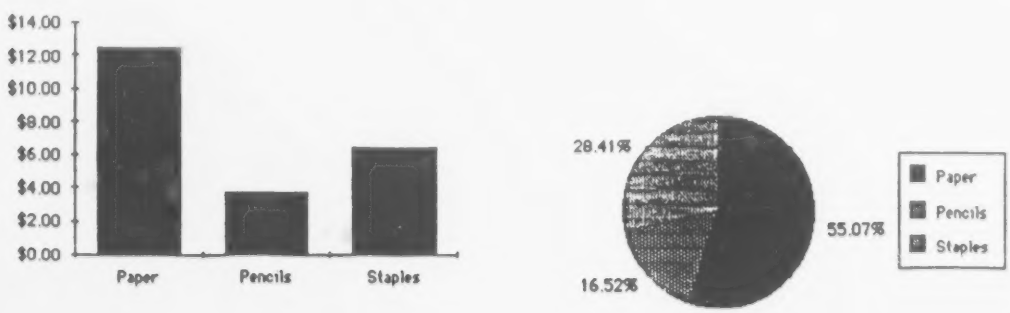
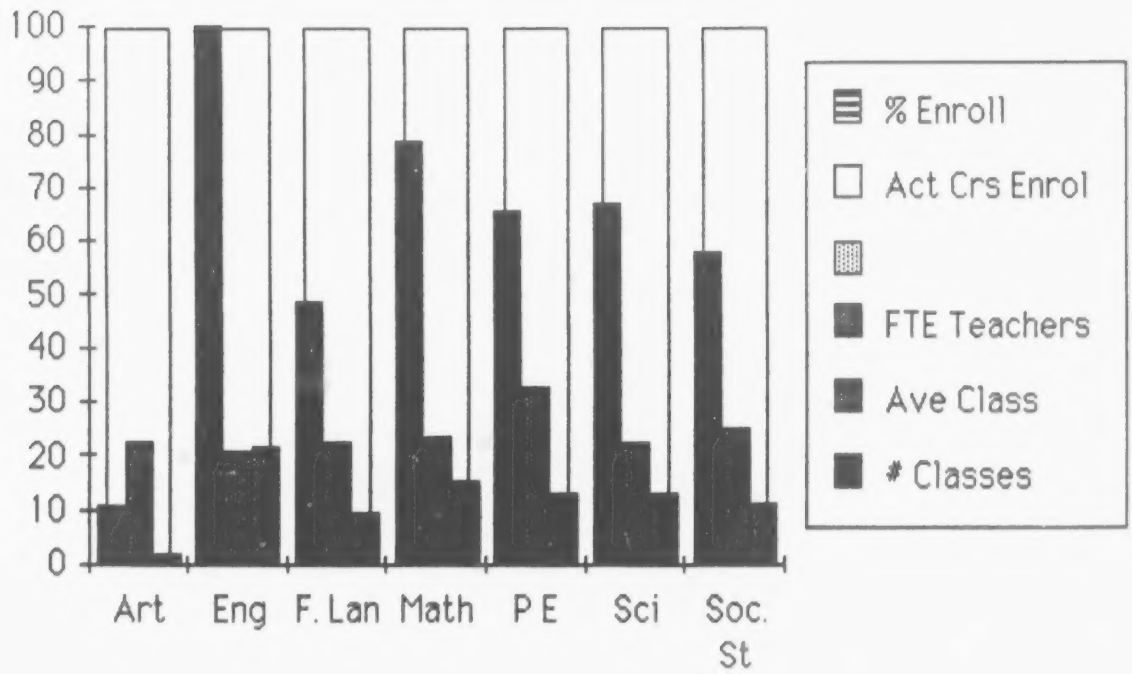


FIGURE 6

CHART 2 – GRAPHS

FIGURE 7



INTERFACING THE COMPUTER IN THE SCIENCE LAB

By: William Kopp, Maine West High School, Des Plaines, IL

One of the exciting new ways to use the computer in the science lab, aside from the utilitarian uses that are applicable to all classrooms, is as a measuring and/or data-recording instrument. There are two ways to go with this effort. One way is to purchase commercial equipment (hardware and software) such as the set-up that I will demonstrate. The other is to use the game port and do it yourself. There is a myriad of literature on this type of use, and many examples will be illustrated and discussed during the session. I prefer the game port method for various reasons, which I will discuss.

Perhaps the handiest way to incorporate the game port (Apple users) is to build an external receptor box which can be permanently connected to the computer. This will make it unnecessary to continuously open up the computer to make connections. Also, it can be constructed as to accept any of the standard banana plug connectors or alligator clips - or whatever you prefer to use. Also, the game port itself can be brought out of the computer so that it, too, is readily available for connection.

Pictured below is the way the game port is situated inside the computer. Notice that the #1 pin is indicated by a dot on the circuit board and that the numbering is usually viewed from the front of the computer.

1	9
2	10
3	11
4	12
5	13
6	14
7	15
8	16

There are three groups of pin arrangements. The push button controls use pins 2 & 8, 3 & 8, and 4 & 8 with pin 8 being attached to ground. These connections, obviously, are either on or off.

The second group of pins allow for variable input. They are 1 & 6, paddle (0), 1 & 10, paddle (1), and 1 & 7, paddle (2). In this case pin #1 is +5 volts. The resistance of the game paddle is 150 ohms and this is digitized by the computer into 255 bits.

The third group of pins, 12, 13, 14, and 15 are called annunciators and are used to interface the computer with such things as houselights, furnace thermostats, etc. We probably will have no use for these pins. Also notice that pins 5, 9 and 16 are blank.

In my experience, the only pins that are really very useful in the science lab are the variables and on, off. The on/off pins can be used for such things as counting, but I have not found them particularly useful.

The variable pins, however, lend themselves to a wide variety of uses - some of which I will either illustrate during the session or provide followup literature for participants. These uses are:

1. to measure acceleration and/or velocity in dynamics experiments.

2. to examine the motion of a pendulum, i.e. period, damping, coupled pendulums, etc.

3. to measure temperature.

4. to measure pH.

5. to use as a light pen.

6. to use as a timer.

7. to measure one's "love potential".

8. to measure volts, amps, power, etc.

9. to measure magnetic fields.

10. and practically anything else that you can produce some variable resistance.

A brief description of these uses follows.

MeasuringAcceleration/Velocity
In order to do this activity, you need two photocells. These can be purchased from most suppliers. Radio Shack photocells are the type demonstrated, however, there are several possible alternatives. These can be connected to Pdl (0) and Pdl (1) at the game port. They are sensitive to a wide variety of light intensities. The program that relates to this is the "FREE-FALL EXP." on the disk. The program steps involve: finding the sensitivity of each photocell. Since ambient light is used, the sensitivity will vary from place to place or even during the course of the day. It is necessary, therefore, to allow for changing the sensitivity - which the program does. After the sensitivity is set, the timing scheme needs to be calibrated. By having the student calibrate the time instead of using the internal timing mechanism (which requires a machine language program), he feels a greater "ownership" of the method. After these two steps are taken, then some sort of experiment might be devised to measure either acceleration or velocity. The "FREE-FALL EXP." which is included on the disk is an example.

Finding Properties of a Pendulum
For this experiment, you will need to devise a pendulun that is fastened to a potentiometer of about 100K to 150K. The potentiometer should be clamped by the housing and the shaft kept free. In the example shown, a meter stick is used as the pendulum and a Fahnestock Clip is opened to use as an attachment device for the meter stick. By connecting the potentiometer to the Pdl (0) connections, and using the proper programming, several periods of the pendulum can be observed on the monitor. Depending upon the mass of the pendulum and the ease of movement of the potentiometer, the period is damped. You can then change the variables to observe different properties. Two pendulums can also be coupled to observe this phenomenon.

Measuring Temperature

Measuring temperature can be done by using a thermister of suitable properties. The particular thermister came from Century Electronics Corporation. The thermister is connected to Pd1 (0) and with suitable programming, similar to the techniques used in the photocell experiment, changes in temperature can be observed. The actual temperature can be determined either by the student calibrating the curve shown on the monitor or by using the equation provided by the manufacturers. Again, it is my feeling that the student is better served if he does his own calibration. He could even devise a transparency to place over the monitor.

The rest of the uses are described in the literature that is furnished at the session or in the manual that comes with the commercial interfacing. However, since time is a factor only a few of the uses are demonstrated. The basic programming is also presented and a disk containing the following programs is available to those who wish to obtain a copy.

1. PORT/PADDLE TESTER
2. PHOTOCELL1 - 1 variable
3. PHOTOCELL2 - 2 variables
4. PENDULUM
5. FREE-FALL EXPERIMENT
6. TIMER

COMPUTERS IN THE DRAFTING CURRICULUM

By: Bruce Laird, Township High School District 211, Palatine, IL
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"CAD has more potential to increase productivity than anything since the invention of electricity." Fortune Magazine

That is a bold statement to make, and an even tougher one to live up to, but it indicates the impact computers are having on design technology today. Computer aided design (CAD) systems based on personal computers (PC) now comprise one of the most active areas of computer graphics. PC CAD has only been accepted for serious design work by engineers and architects in the last two years. Prior to that, mainframe CAD was the way of life. Until recently, CAD has been limited to the large corporations, with the price tag from $100,000 to $300,000 per workstation, making cost the major barrier to widespread use of the technology. Systems based on personal computers have virtually eliminated the price barrier with PC workstation cost ranging from $8,000 to $15,000 including software. As acceptance of PC CAD continues to grow and the cost decreases, the opportunities and advantages of CAD are becoming available to companies of all sizes. One estimate is that nine of every ten new installations of CAD systems will be PC CAD by the end of the decade.

Where and how does education fit into the CAD picture? PC CAD is impacting education in a manner similar to the way it has impacted industry. With ten to fifteen percent of all potential CAD users presently online, and with the anticipated need of 1.9 million trained CAD operators by the end of the century, the opportunities for the education community to assist industry in meeting their training needs is exciting. Currently, CAD software that will run on an Apple computer is available for fifty dollars. This software will allow the student an opportunity to understand the concepts of CAD and how the individual interacts with the computer. Establishing and developing a suitable CAD training program can be a confusing experience. Equipment and software it seems, is being improved daily. This only adds to the difficulty of decision making. While each piece of software possesses its own unique features and terminology that may require directed instruction, the general concepts of creating geometry and graphics have a basic approach. The best advice is to become familiar with computer equipment and CAD concepts, know the terminology and be able to communicate it. An instructor should be willing to be flexible and willing to learn from his students.

CAD skills, like other skills, can be taught and learned in an educational environment. Just as drafting is an acquired skill, CAD will become a necessary skill in the design community. In engineering and design settings where professionals are currently using drawing to communicate their designs, CAD will play an increasingly important role in increasing efficiency and productivity. The computer in drafting programs, as taught through CAD concepts, can serve as a positive reinforcement for students. The computer in drafting allows the student to be at the threshold of state of the art technology at the time the technology is changing. In vocational education, this has often been difficult to accomplish. The computer in drafting is a tool, just as the drafting machine combined the capability of various individual drafting tools, the calculator replaced the slide rule and the word processor has improved on the typewriter. It reduces, if not eliminates, the

laborious and tedious tasks involved with drafting.

CAD presents many possibilities for both the present and the future. For example, Chrysler Corporation used CAD systems to design approximately 45% of its 1986 models. Plans call for the acquisition of equipment and trained personnel to design 100% of Chrysler's products for the 1990 production year. Drafting programs must keep pace with this sort of changing job market if the programs are to remain viable.

The drafting program in District 211 makes use of CAD software developed at the Milwaukee Area Technical College (MATC). This software emulates the operation of a 2D system distributed by Computervision. The MATC CAD software has been very reliable and provides students with realistic experience. Both a student manual and a teacher manual are available from MATC. Beyond the warranty period, user support has been readily available via the telephone for an annual fee. The newest release, a complete re-write to compress the code to fit on a single diskette, was acquired for just $10.

The version of MATC CAD in use runs on the Apple II family of computers with 64K of memory and two disk drives, the Apple graphics tablet is used as the input device. Alternately, a joystick may also be used for input, but is less precise for this purpose. Hardware and software is available for use on 16 workstations at the high school.

The graphics tablets have been the greatest area of concern. A number of the graphics tablets have failed due to identical malfunctions, either immediately upon installation or after a period of use. Some of these failed after as much as a year of use. In some cases, the replacement tablets experienced the same malfunction within the same time frame. The authors have cooperated with the manufacturer in attempting to identify the cause of the problem, however no resolution of the situation has ever been explained by the manufacturer. The authors hope that the manufacturer has identified the cause of the problem, has rectified the situation at the manufacturing level and either repaired the service exchange units accordingly or removed the affected units from the service exchange module pool.

Output of completed drafting work is produced either on one of four Epson dot matrix printers for a draft copy or a Hewlett-Packard 7475A 6-pen plotter for the final plot. Other printers and plotters are supported by the software.

Use of the CAD system is implemented in each course in the drafting curriculum, from the introductory course at the freshman level through the independent study course at the culmination of the drafting course sequence. At each level, students receive instruction in the use of the CAD system functions relevant to the course and are provided approximately three and one-half weeks of hands-on practice in using the system. Independent study students spend a greater portion of their class time using the CAD system.

Through two semesters of use, the MATC CAD system has shown to be an excellent, well-supported product. The experiences have served as a starting point for development of a broader CAD-based curriculum as part of a regional vocational system in the northwest suburban Chicago area. Just as in industry, the use of CAD in education is thriving in its infancy.

EFFECTS OF LOGO ON PROBLEM SOLVING
A CLOSE LOOK AT THE RESEARCH

By: Michael Land, National College of Education, Evanston, IL

There's a romantic love affair currently going on between the teaching of Logo programming in the public schools and our intrigue with problem solving. The offspring of this affair is **technoromanticism.** Proponents of teaching Logo have argued that learning to program IN LOGO helps develop higher level cognitive skills. It's easy to see why this appear to be such a romantic notion: many of the skills--or at least the labels we use--appear to be the same for both problem solving and programming: procedural thinking, formulating a plan, examining the relationships among variables, finding and correcting errors. Feurzeig et al. (1981) have provided an extensive list of the cognitive outcomes expected from learning to program. These skills include logical thinking, understanding of concepts such as procedural thinking, ability to find and correct one's errors, and recognition that there is rarely one best way to do something. We have come to assume that the process of learning programming results in better problem solving and have used this as one of the reasons for teaching programming in our schools.

What is the empirical basis for assuming that problem solving skills can be improved by learning Logo programming? To survey the research literature, I searched the following research databases: Dissertation Abstracts International, Educational Resources Information Catalog, and Psychological Abstracts.

The studies reviewed here can be categorized into two main areas: those that focused specifically on the influence of programming in Logo on mathematical skills, and those that focused on the influence of programming in Logo on more general problem solving skills, including studies reporting the comparative effects of Logo, BASIC, and other languages.

THE EFFECT OF LOGO ON MATHEMATICAL SKILLS

Among the first group of studies is the Edinburgh Logo Project (Howe et al., 1979), in which Logo programming was taught for about one hour per week over a two-year period to sixth grade boys selected from the lowest level math class in a private school. During the second year, extra time was spent outside normal school hours on Logo activities that were especially designed to teach troublesome topics in the regular mathematics curriculum. Standardized pre and post tests measuring mathematics achievement were given to the Logo group as well as to a control group selected from the next to lowest math group. The experimental group showed somewhat more improvement than the control group on the Basic Mathematics Test, but the reverse was true on the Math Attainment Test. Thus, over a two-year period, the study provided mixed and inconsistent results on whether learning Logo affected math achievement.

THE EFFECT OF LOGO ON GENERAL PROBLEM SOLVING SKILLS

In another study with a stronger research design, Statz (1974) gave pre and post tests to 16 fourth graders who participated in Logo sessions and to a similar group who remained in the regular classroom. The problem solving test consisted of four parts: a twenty questions game, the Tower of Hanoi puzzle, a task to generate permutations, and a word classification task. Statz found

that, when the two groups were controlled for mathematics achievement, students who learned Logo over a period of one year performed significantly better than the control group on the permutation and word classification tasks. When the two groups were blocked on I.Q. scores, however, the effect was significant only for the permutation task; no significant differences were found on twenty questions or the Tower of Hanoi.

Seidman (1980) investigated the effect of learning programming (Logo) on logical reasoning skills. Forty-two fifth graders were randomly placed either in a group that received 30 minutes of Logo instruction over the course of 15 weeks or in a group that received no special instruction. After the treatment, both groups were given a series of tests measuring their understanding of conditional statements (statements which use "if," "if...then," "only if," and "if and only if"). No significant differences were found between the two groups when the items were scored in the traditional way. However, when the items were rescored to allow for students' misinterpretation of the conditional (if...then) as a biconditional (if and only if), the experimental group did significantly better than the control group on one of the four logical principles.

Gorman & Bourne's (1983) study of the Lamplighter Project in Texas was similar to that of Seidman in that both were concerned with the effect of learning Logo on logical reasoning skills. In the Lamplighter study, Gorman used a "rule-learning" test. Children were shown a series of shapes in different colors and sizes and then were asked what features satisfy the rule of the experimenter. For example, pictures of red circles and a variety of non-red shapes fit the conditional rule "if red, then circle; if not red, then any shape". Forty-nine third graders were randomly assigned to one of three classes. For one hour per day, children in all three classes received the same in-class Logo instruction. Two of the classes, however, received an extra one-half hour per week of individual computer time, and the other class received an extra hour per week. At the end of the school year, five children were randomly selected from each of the three classes and tested individually on the rule learning task. The students who studied Logo one extra hour per week performed significantly better than the other two groups on the task of learning the conditional rule.

In widely reported research at Bank Street College of Education, Pea & Kurland (1983) compared the planning abilities of 16 children, ages 8-9 and 11-12, who had Logo experience, with a control group of 16 children of the same age who had not studied Logo. Students in both groups were asked to use a map of the classroom to devise an efficient plan for doing familiar chores, such as cleaning the blackboard and moving furniture. There were no significant differences between the groups on the efficiency of the plans or the types of decisions made during the planning process.

Rieber (1983) reported significant gains (there were 25 students) for an experimental group of second graders both in systematic thinking (based on Piagetian theory) and transfer of geometric concepts to paper and pencil activities. The treatment consisted of one hour per week of programming in Logo over a period of 3 months.

Clements (1985) studied the effects of learning Logo on the cognitive abilities of first graders. Eighteen first graders were randomly assigned to either a Logo programming group or a CAI control group. Pre and post tests

were given to determine the children's level of reflectivity (thinking before answering), divergent thinking (creativity in drawing), vocabulary, metacognition (thinking about their own thinking), logical thinking (measured by Piagetian tasks involving left right orientation, verbal and numeric memory, and drawing a design), and ability to describe directions using a simple street map. Although the two groups were equivalent in school success before the treatment, after 12 weeks the Logo group significantly outperformed the CAI group on reflectivity, divergent thinking, metacognition, and describing directions, but not on the other measures. Clements concluded that although Logo programming may not affect the cognitive development of first graders when compared to CAI, it may affect the way in which children use the cognitive abilities they have.

Rood (1983), working with 76 second through ninth graders, studied the effects of Logo and BASIC on problem solving skills as measured by the Social Sciences Piagetian Inventory. Both groups showed positive pre to post test gains, but there were no significant effects on problem solving or on locus of control (Norwicki-Strickland Locus of Control Scale for Children) or on self-esteem (Coopersmith Self-Esteem Inventory).

Milojkovic (1984) randomly assigned 58 fifth graders to one of four groups. Two groups learned programming via computer graphics; one of these groups learned Logo and the other BASIC. A third group used computer software designed to develop problem solving skills. The fourth group had no contact with computers, but used print materials to learn problem solving skills. Each group met for 45 minutes three times a week for 10 weeks. Pre and post tests were given on a variety of cognitive measures: mental rotation of cubical figures, embedded figures test, mapping skills, understanding of variables in algebra, Ross Test of Higher Cognitive Processes, means-ends problem solving. He reported no significant results on the cognitive benefits of learning programming.

In a study of the effects of Logo, BASIC, general study skills, and no training on ten year olds, Gaffney (1984) reported no significant multivariate differences and only one univariate difference on general problem solving ability, transfer to an isomorphic task, and the ability to use recursion. The post test consisted of five problem solving tasks.

Horner (1984), working with 74 learning disabled and non-learning disabled junior high students for 14 class periods over six weeks, had the experimental groups working with Logo and the control groups working with the regular math instruction. Using a two-way analysis of covariance procedure, she found no significant differences between type of class (learning disabled versus non-learning disabled) or between type of treatment (Logo versus regular math) on problem solving, locus of control, mathematics attitudes, or angle recognition. There were significantly more students categorized as internal based on attributions toward Logo than students categorized as internal based on pretest locus of control scores.

Odom (1984), using 36 volunteer fifth and sixth grade students placed randomly into treatment groups, studied the effects of programming in Logo for eight weeks on analysis, synthesis, and evaluation skills (as measured by the Ross Test of Higher Cognitive Processes). All students took the test at the beginning and at the end of the treatment period. The students working with Logo had significant increases in analysis and evaluation skills, but not in

synthesis skills, as compared with the non-participating control group.
Shaw (1984), working with 132 fifth grade students one hour per day for seven weeks, studied the effects of no programming, Logo, and BASIC on problem solving (New Jersey Test of Reasoning Skills.) There were no significant results for a programming language versus no programming, or between BASIC and Logo.

Van Dyke (1984), working with 27 nine to twelve year olds for a period of three weeks with Logo, studied the correlation between creativity (Torrance), intelligence (Otis-Lennon Mental Abilities Test), style of learning (A Children's Form of Your Style of Learning and Thinking), and achievement on a paper and pencil test (convergent in nature) involving Logo graphics and list processing. She cited significant correlations between intelligence and the test results, and between verbal creativity and list processing but no significant correlations between figural creativity and the test results. She indicated that the results of this study failed to provide support for previous studies showing that Logo could increase divergent thinking as measured by the Torrance instrument.

Reimer (1985) studied the effects of Logo on readiness, creativity, and the self-concept of 16 kindergarten students (nonrandomized control group). Subjects in the experimental group participated in twenty 35 to 40 minute periods of Logo programming and related activities; the control group remained a part of their kindergarten class. Reimer reported significant differences in favor of the Logo group for 4 items of the Brigance readiness test (visual discrimination, visual motor skills, visual memory, and number recognition) but no differences for creativity (Torrance) or self-concept (Muller).

In summary, the research to date provides inconclusive and apparently contradictory results on the cognitive benefits of learning to program. The studies are difficult to compare because their operational definitions of problem solving are so different. Even in the two studies (Seidman, 1981; Gorman & Bourne, 1982) that investigated the effect of learning Logo on students' understanding of "if...then" statements, the assessment instruments were very different and the results were contradictory.

Tetenbaum & Mulkeen (1984) have pointed out that training in problem solving skills does not generally transfer from one task, such as programming in Logo, to success on another task, such as interpreting conditional statements or solving the Tower of Hanoi puzzle. Simon (1980) has noted that transfer is enhanced when (a) some of the skills used in the second task are **identical** to those learned in performing the first task, and (b) when the learner is made explicitly aware of the skills involved, apart from the specific content of the task.

One of the major problems associated with conducting research of the effect of learning to program on problem solving skills, whether it be Logo or another language, is how to define and measure problem solving. Many researchers use the general term `problem solving' to describe the cognitive outcomes expected. The literature indicates that there are nearly as many operational definitions of problem solving as there are research studies. Hence, without critical analysis, we have come to assume that the process of learning programming results in better problem solving. Logo may indeed have significant effects on certain thinking skills, but we need the empirical evidence before we make any more sweeping claims for its effects. To claim

that standard research methods do not apply to Logo is easy; if that is a valid claim, then those who make that claim need to come up with a valid and reliable method for determining with objectivity the effects of Logo, rather than just presenting individual case studies--the weakest possible evidence!

The implications for teachers are to be analytical with regard to the experimental research evidence and to make more explicit the links between problem solving in the context of programming in Logo and problem solving in other contexts.

REFERENCES

Clements, D. H. (1985). Logo programming: Can it change how children think? Electronic Learning, 28, 74-76.

Feurzeig, W., Horwitz, P., & Nickerson, R. S. (1981). Microcomputers in education (Report No. 4798). Prepared for: Department of Health, Education and Welfare; National Institute of Education, and Ministry for the Development of Human Intelligence, Republic of Venezuela. Cambridge, MA: Bolt, Beranek and Newman.

Gaffney, C. R. (1984). Computer languages: Tools for problem solving? The University of Texas at Arlington, DAI, 45/09-B, 3097.

Gorman, H., Jr. & Bourne, L. E., Jr. (1983). Learning to think by learning Logo: Rule learning in third-grade computer programmers. Bulletin of the Psychonomonic Society, 21, 165-167.

Horner, C. M. (1984). The effects of Logo on problem solving, locus of control, attitudes toward mathematics, and angle recognition in learning disabled children. Texas Tech University, DAI, 45/06A, 1716.

Howe, J., O'Shea, T. & Plane, F. (1980). Teaching mathematics through Logo programming: An evaluation study. In R. Lewis & E. Tagg (eds.) Computer Assisted Learning: Scope, Progress, and Limits. New York: North-Holland Publishing, 85-102.

Milojkovic, J. D. (1984). Children learning computer programming: Cognitive and motivational consequences. Stanford University, DAI, 45, 385.

Odom, M. L. N. (1984). The effects of learning the computer programming language Logo on fifth and sixth grade students' skills of analysis, synthesis, and evaluation. University of Arkansas, DAI, 45/08A, 2390.

Pea, R. D. & Kurland, D. M. (1983). Logo programming and the development of planning skills. New York: Center for Children and Technology, Bank Street College, Tech. Rep. No. 16.

Reimer, G. (1985). The effects of a Logo computer of programming experience on readiness for first grade, creativity, and self concept: A pilot study in kindergarten. AEDS Monitor, 23 (7,8), 8-12.

Rieber, L. P. (1983). The effect of Logo on increasing systematic and procedural thinking according to Piaget's theory of intellectual development and on its ability to teach geometric concepts to young children. University of New Mexico, unpublished masters thesis.

Rood, M. K. (1983). Locus of control, self-esteem, and the acquisition of problem solving skills through the instruction of Logo and BASIC computer programming languages in gifted children. The University of Connecticut, DAI,45, 469.

Seidman, R. H. (1980). The effects of learning the Logo computer programming language on logical reasoning in school children. Syracuse University, DAI,45, 2249.

Shaw, D. G. (1984). The effects of learning to program a computer in BASIC or Logo on the problem solving abilities of fifth grade students. North Texas State University, DAI, 45/07A, 1985.

Simon, H. (1980). Problem solving and education. In D. T. Tuma & F. Reif (Eds.), Problem solving and education: Issues in Teaching and Research. Hillsdale, NJ: Lawrence Erlbaum Associates, 81-96.

Statz, J. (1974). The development of computer programming concepts and problem solving abilities among ten year olds learning Logo. Syracuse University, DAI, 74/5418-B.

Tetenbaum, T. J. & Mulkeen, T. A. (November 1984). Logo and the teaching of problem solving: A call for a moratorium. Educational Technology, 16-19.

Van Dyke, J. S. G. (1984). The relationship between Logo and creativity (brainstorming, imagery, problem solving, creative process). Texas A & M University, DAI, 45/09-A, 2815.

EFFECTS OF LEARNING LOGO ON PROBLEM SOLVING

AUTHOR	INDEP VARIABLE	DEPENDENT VARIABLE	GRADE	N	DESIGN
Clements (1985)	Logo, CAI	cognitive style & development	(6yr)	18	R-control, pre post test
Gaffney (1984)	Logo, BASIC, & other	problem solving	(10 yr)	??	post test
Gorman & Bourne (1983)	Logo	rule learning	3rd	49	R-control post test
Horner (1984)	Logo, math	problem solving	Jr Hi	74	criterion,intact pre-post test
Howe et al (1980)	Logo	math achievement	6th males	11	non-R control pre-post test
Milojkovic (1984)	BASIC, Logo, CAI	cognitive tasks	5th	58	R-control, pre-post test
Odom (1984)	Logo	Ross P-S	5th, 6th	36	R-control, pre-post test
Pea & Kurland (1983)	Logo	planning	8-9, 11-12	32	matched control, post test
Reimer (1985)	Logo	Readiness	K	16	non-R control ??
Rieber (1983)	Logo	systematic thinking	2nd	25	non-R control, pre-post test
Rood (1983)	BASIC vs Logo	P-S, locus of control	2nd -> 9th	76	non-R pre-post test
Seidman (1980)	Logo	conditional logic	5th 10-11	42	control, post test only
Shaw (1984)	Logo, BASIC, none	New Jersey reasoning skills	5th	132	control, pre-post test
Statz (1974)	Logo	4-part problem solving	9-11	32	control, pre-post test
Van Dyke (1984)	Logo	Logo achievement	9-12	27	correlation

BACK TO THE FUTURE
FUTURE DIRECTIONS IN EDUCATIONAL COMPUTING

By: Robert A. Longo, Apple Computer, Inc.

In the movie, "Back to the Future", we saw Michael J. Fox use the very latest state of the art technology to allow him to go back in time in order to rediscover lost values. I would like to discuss this same kind of rediscovery that must happen in the educational computer evolution. The novelty of the computer has had its time. It can no longer survive as an end in and of itself. Namely the focus on teaching computer, whether that is literacy or programming, will continue to be important in computer education in the early stages, possibly this may eventually happen before a child ever enters his or her formal education. We cannot afford for this to continue to be the focus in the future. The real value of the computer must be what we refer to at Apple as "The Power Tool for the Mind". It must be a powerful tool for discovery--a tool that can free students and teachers from the mechanical constraints of learning.

Bill Campbell, Apple's Executive Vice President, has said, "We view a personal computer as a tool for expression; a tool for design--as well as for analysis. It can stimulate the stages in the formation of a snowflake. It can extend the realm of the experimental universe by allowing experiments to be performed hypothetically. In short, it is an intellectual instrument, one that liberates the person of ideas to do critical thinking."

Reaching toward this vision we must provide solutions for achieving curriculum objectives, not just hardware. We must address the challenge of classroom management, not just individual applications. We must help administrators manage the business of running schools and school districts.

Mike Gordon, Director of CADRE Computer Consortium, noted that, "Immediately teachers will learn to use computers as tools, educational appliances to teach subjects that they are already teaching. Later, comfort with the tool will change the classroom. Accessing databases of information, communicating with other students in other areas to research ideas and putting together information in ways that does not happen now in regular classrooms. Students will become more responsible for learning. The teacher will be more of a guide than a transmitter of information."

As a secondary teacher I found out early that many times the best learning takes place when the teacher acts as a facilitator. The teacher who understands when it is time to get out of the way and let his or her fledglings fly on their own is often surprised by their incredible results. As a part of an Advanced Communications course I once taught a unit on Conference Management. I thought that it would be really neat if the kids could go through the experience of running a conference first hand. So I rescued a defunct idea that the faculty had on running a Social Awareness Day at the school, and threw it at my students as a challenge. Before it was all said and done, they had invited over 30 social agencies to participate (like Catholic Charities, the American Cancer Society, the Red Cross and Alcoholics Anonymous). Ara Parsegian was invited to the keynote speaker. Local T.V. and radio personalities were invited to run workshops. Segments were broken down into large group presentations, small group workshops, multi-media shows, and discussion groups. The event was reported on all 3 major T.V. stations, in

both newspapers and on a number of radio stations. They invented a new bell system for short classes, and a student tracking system that was so good that the school adopted it for its special short bell schedule. They knew where every kid was every hour of the day. They had evaluators sitting in on every session and after the conference submitted a detailed evaluation on the success of the event. The head of Catholic Charities in the Diocese of Cleveland sought me out afterwards to say, that for two weeks before the conference someone called his office every day to insure that he was still planning on attending. He noted that this was the best managed conference that he had ever attended. It taught me a special lesson of what can happen when you provide your students with the right tools and knowledge and then give them the authority and responsibility to creatively apply the information that you have given them. It scares me to think what they could have done if they had the support of a computer.

It is important that we begin to carefully experiment and analyze our transition into the future. Apple is attempting to do this through a program called the Apple Classrooms of Tomorrow (ACOT). This is a special study in which Apple is examining the impact of computer intensity both at home and at school. The selected schools were already on a course to do this type of an experience with or without Apple's help. All the students in the participating classes have an Apple at school and at home (in most cases this is an Apple II, but in some it involves Macintoshes).

The classroom of tomorrow includes computers for parents and teachers too. They will be linked by electronic mail so parents will have a way to communicate with their childrens' teachers. Some of the courses will be designed around integrated programs like APPLEWORKS. As advanced products demand a reality check, Apple will have these 1980 versions of the "GE Kitchen of Tomorrow" to test your future products. Frankly, we want to see what happens when every student has a desk, pencil, books, and a personal computer. When every teacher and parent has a way to store information and move it from place to place. And when every child who is sick can learn at home and keep up with the class. Even more importantly will be the analysis of the data we gather from these projects and our ability to share this will all of our customers. Hopefully we will be able to answer questions like: Is a highly saturated computer environment a good thing? What are the benefits of integrating micros into the K-12 curriculum? What advantage do schools have who have built their curriculums around programs like APPLEWORKS? Can we demonstrate that achievement advantages exist with kids who have micros at home and at school? What kind of affective and cognitive results are we finding from micro intensity? Does the computer help improve attendance, reduce hostility, instill a love and an enthusiasm for learning?

Many educators are working very hard to define what is the current reality, and what kind of a future should they be working and planning for. Here is what some of them have said.

Bernie Kelly of High School District #214 in Arlington Heights suggested that, "Today computers are integrated into all areas of our curriculum. In the near future we hope to have six labs in every building, so that computers can be productivity tools in all curriculum areas. Interactive video will play a big part, as more disks become available. In the "future-future" we will see every student having a notebook-sized computer with attached keyboard, three-four line display, built in paper with a laser printer. We will move from

slate and chalk, to paper and pencil, to kids and personal pocket-sized computers."

Dr. Carl Berger, Dean of the School of Education at the University of Michigan, stated the following: "General computer education has evolved to the point where the computer is no longer an oddity, but a necessity. The software has evolved where computers are easily integrated into all aspects of the education process. General productivity tools such as spreadsheets, databases, charts, and monitoring instruments are playing an increasingly important part as a natural tool for the teacher. What will dramatically allow computers to penetrate the classroom is the evolution of icon driven technology. In the past year that the University of Michigan has offered courses in microcomputers, their Mac lab is occupied 90% of the time compared to 5% of the time on the IBM side. This is directly related to the user friendliness of the Macintosh. What takes one evening to learn on the Mac, takes three evenings on the IBM."

John Soudah, of the Northwest Indiana Educational Service Center, sees the technology moving to "Networks, LANS in offices and classrooms sharing storage devices and peripherals. The next generation of administrators will be very computer literate. Classroom teachers will be using computers in more specific ways in cognate areas rather than as general tools."

In line with what John Soudah mentioned about networks, Apple's Chairman and President John Sculley declared at the MECC Conference that, "Before the end of 1986 and going into 1987, the education market should expect to see from Apple a strategy and implementation with real products that bring network services to the classroom. Teachers will not only be able to download software to the individual workstations, but eventually we will be able to have an interactive interface between teachers and their students so that different students can be doing different things and the teacher can be managing that. What's exciting about Apple's commitment in this direction, is that our solutions are going to be able to work with the installed base of equipment; you won't have to throw it all out and start over again."

Dr. James A. Adams, Superintendent of the Indiana Public Schools, made the following comments: "I believe presently we are in a period of true assessment regarding the effective use of microcomputers in education. The period we are in now is one where trends are beginning to "settle out". The following management areas are presently being impacted: (1) management of administrative data; and (2) management of classroom information by instructors. I see the greatest future potential impact from curriculum/instructional point of view as follows: (1) Language arts--the utilization in teaching word processing skills and also developing writing skills. The micro will free the teacher to devote more energies to more creative endeavors. (2) In more specialized curriculum areas, such as science, micros will be used to analyze chemical contents and science experimentation. (3) For the use of spreadsheets by students to develop hypotheses using "what-if" situations and financial management areas. (4) One instructional area which we are just beginning to scratch the surface is for library usage--information retrieval using data bases for research. (5) The integration of video with the microcomputer offers tremendous possibilities when these two areas are "married" to their fullest extent. (6) Computer literacy will not continue to be as popular in the future since software being introduced today is more user-friendly."

One of my favorite educators, my brother, Dr. R. Gerard Longo, Superintendent of the Steel Valley Schools in Pittsburgh, PA, one of the hardest economically hit districts in the country, has a different view based on the uniqueness of his constituency. Jerry believes that, "The children in our community have no technology; the technology to them exists at places like Carnegie Mellon, but all they see from here is the "Rustbowl". The computer offers kids from families of "Smokestack Industries" a new way to view and to relate to their environment. It suggest hope. The school has the responsibility to be the vehicle to expose our kids and allow them to experience the technology. This must be a very flexible vision. The computer's strength is that it can adapt to almost any environment. In the past its place in math and science has been clear, next this pervasive tool must apply across the curriculum. I view the future as one that continues to move away from focusing on individual achievement, to one that emphasizes team success. This is primarily a work group concept. The direction of computing is with networked electronic devices that can help the teacher to blend different functions together to provide a better result. The ability to share software, printers, and access databases of information will help us make this transition to work group success."

Finally, Sally Sloan, Technology Coordinator of the Minneapolis Public Schools, offers this very interesting perspective: "Everybody's future is somebody's past. Everyone is starting from different places so it is hard to compare one's school situation to another's. We have had computers since 1968, we have interactive video, satellite communications, cable networks and we are using computers for everything from maintaining blueprint records of our building to office word processing. We are beginning to use word processing the way we use to use pencils. The inhibitors are still the same: money, attitudes, and the slow moving bureaucracy of public education. As advanced as we are in some ways, it still took me three years to get a Macintosh in every building. Even though everyone wanted them there were still the logistical problems. Keep your visions clear: Be sure you know what you are trying to accomplish--know where you are going. Be solution oriented. Don't get caught up in the "Hot Box" game. Although we have a very powerful 32 bit, mega byte machine, Apple is not threatened if you take a solution approach that considers the hardware as secondary to the solution of your problem. Be sure to consider the quality of the available software, what collateral materials there are to help build your course. In other words, put the computer itself into the background. Stanford University has created a simulation that takes place during the reign of Louis the XIVth. It forces the student to consider all kinds of decisions in order to improve his lot in life. Such as, strategic marriages, ownership of property, education, trading and so on. This piece of software makes the Macintosh a very valuable piece of hardware, without it the friendly user interface really has little value."

In closing I would like to reiterate a statement that was made by John Sculley at the MECC Conference that I feel sums up Apple's commitment to the Education marketplace: "I know that many educators stuck their necks out, at different points in time, when people were doubters as to whether personal computers really were going to be important to education. But like the pioneers of the Oregon Trail, I think that it's a privilege to be on the forefront--on the leading edge. I have come here tonight to reaffirm that Apple's first business is education. You are the ones that we respect and want to strengthen our relationship with because you are the people who understand

that by working together we can make the tremendous difference; not just in schools, but also in the way that society prepares itself for the next century."

COMPUTERS IN EDUCATION IN THE USSR - REPORT ON A VISIT

By: Peter Lykos, Illinois Institute of Technology, Chicago, IL

In June, 1978, I gave the keynote address at the 4th International Conference on Computers in Chemical Research and Education at Novosibirsk, USSR. The title of my paper was "Personalized Computing and Chemistry". The paper went into the brief history of personal computers, dwelled at some length on the Processor Technology "SOL 20", a desk top personal computer which was probably the `Cadillac' of its time and then went on to discuss some of the implications of that emerging technology buttressed by 13 references. The paper was included in the proceedings of that Conference published by the USSR Academy of Sciences Siberian Division.

preceding the 7th ICCCRE in FRG,

In June, 1985, I spent seven days in the USSR - one day in Minsk, three in Moscow and three in Novosibirsk (more accurately in Academgorodok, `science city', just outside of Novosibirsk). I was a guest of the USSR Academy of Sciences and spent most of my time in intensive discussions with small groups of Soviet chemists using computers in connection with their research. While in Novosibirsk I was introduced to two separate computers-in-education laboratories (and had no problem taking photographs in both of them).

The changes in personal computer sophistication between my two visits were quite striking.

One of the laboratories was in Novosibirsk State University and the machines there were equipped with analog to digital and digital to analog devices so that data logging in real time could be done. Each system had two displays - one for alphanumeric information and the second for graphics. While I was there, persons who I took to be factory personnel were being introduced to on-line computation at times when the students at the University were not using the equipment.

The computer lab I saw in the prestigious secondary school in Novosibirsk had color displays, not black and white TV sets. I did not see around each desk a bird's nest of electrical wiring. The keyboard casings did not appear to me to be ill-fitting, let alone bear the marks of hammers. The desktop computers did have floppy disk drives and the students working at the machines seemed to know what they were doing as they demonstrated to me the programs they had written. While I was there, groups of visitors were being shown around. Clearly what I was witnessing was a model classroom and being used as such within the USSR.

Furthermore, unlike the situation in the US, the Soviets have taken a hard look at the computer languages and supporting software being used in the US in the K-12 context and have put some of their best computer scientists to work to develop a software environment designed to support computer use by students in the classroom. That system (called Schoolgirl) reflects mature thinking and analysis in my judgment.

The several thousand Yamaha machines purchased are so-called MSXs, a design intended to introduce standardization into the entry-level computer market in education. The president of the Japanese Ascii Corporation has a close association with the Microsoft Corporation in the US which has helped to set

association with the Microsoft Corporation in the US which has helped to set standards for basic software in the US Ascii designed MSX.

Figures one and two give the keyboard layout for the USSR personal computers I saw and the specifications for the computer language (really a multi-language integrated system) for use in schools from elementary through high school.

The third figure gives a problem outline and the corresponding program for a chemistry course (rate of chemical reaction).

In summary, the Soviets have nothing like the lavish computer power support we have, so they emphasize algorithmic approaches to problem solving. Seems to me a middle course between those two extremes would be about right.

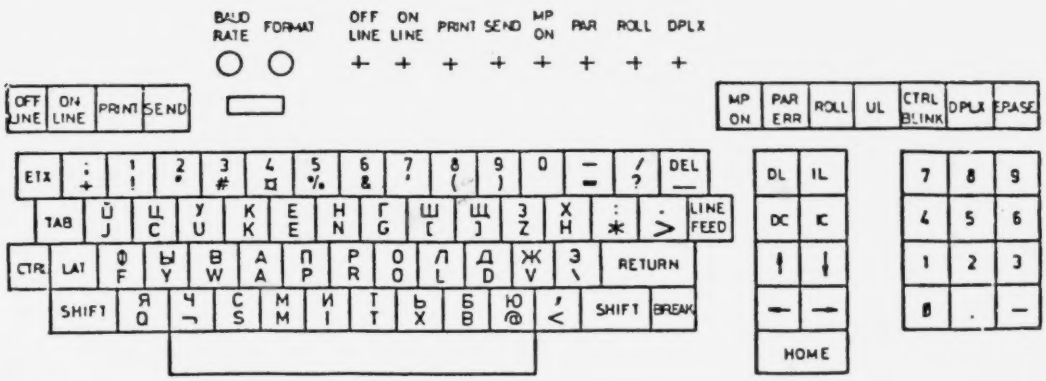


Рис.3.Клавиатура терминала VDT - 52106

FIGURE 1

"Shkol´nitsa" System

An Apple II Computer Environment Software
Package to Support Educational Use of
Computers Designed and Built in USSR.

Shkol´nitsa is an integrated programming environment with three levels of availability:

1. **Application**: Direct keyboard interaction by a non-programmer user via a problem/object-oriented language.

2. **Programming**: Program development, editing, and execution, using two standard languages, ROBIK, a Logo-like primary education language and RAPIRA, an original language with features from PASCAL, SETL and POP-2 educational/working language.

3. **System**: System maintenance, extension and modification by system programmers.

"Shkol´nitsa" System

Functional Capabilities as a programming system:

Multi-language with batch and interactive modes of program execution.

Screen text editor.

Program execution monitor.

Instrument program development support system.

Functional Capabilities as an educational system:

Computer literacy - introduction.

Languages and programming fundamentals.

Individualized operational environment.

Full range of calculation, logical, visualization and information computer capabilities.

Front end small computer applications.

FIGURE 2

FIGURE 3

EXCERPT FROM PROBLEM OUTLINE AND CORRESPONDING PROGRAM FOR A CHEMISTRY COURSE

ПОСТАНОВКА И ПОСЛЕДОВАТЕЛЬМНОСТЬ РЕшЕНИЯ ЗАДАЧИ

Задание разоивается на несколько эталов.

```
      CALL ERASE (ϕ)
      CALL VECTI(1,ϕ,255,255,255)
      CALL VECTI(1,ϕ,255,ϕ,ϕ)
      TYPE*, ` ВВЕСТИ КОНСТАНТы СКОРОСТЕы К1 И К2´
      ACCEPT 2,C1
      ACCEPT 2,C2
2     FORMAT (F6.2)
      T=0.
      DO 6 I=1,255
      T=T+.015
      A=(C2+C1*EXP(-(C1+02)*T))/(C1+C2)
      IA=INT(255-255*A)
      IB=255-IA
      CALL POINT(1,I,IA)
      CALL POINT(2,I,IB)
6     CONTINUE
      STOP
      END
```

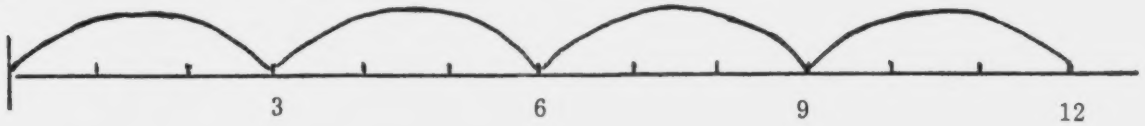
THINKING ABOUT THINKING

By: Kathleen Martin, Texas Christian University, Ft. Worth, TX

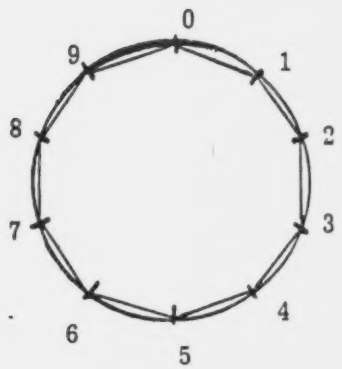
Most of us would be appalled if we saw a student grab a $300 Bausch and Lomb microscope and use it to drive a nail into a piece of wood. Although the microscope would probably get the job done, a hammer is a more appropriate tool for nail-driving. Oftentimes I wonder if the computer does not suffer the same abuse. We use it to nail down information, to hammer home information, and to drill information. While the computer can be used to pound information, typically called drill and practice, that certainly is not its most effective use. Rather than operating as a tireless tutor in the task of mastering answers, the computer can serve as a co-worker in the quest for insights into important ideas.

In describing Logo, Papert says that the language offers "objects-to-think-with." I would further suggest that Logo offers objects-with-which-to-ask-questions." I would like to demonstrate some important ideas that can emerge in working with Logo and to describe how appropriate questions can encourage and cultivate those ideas. On one level our content will be mathematics (what we are thinking about), while on another level our content will be processes of conceptualization (how we are thinking about what we are thinking about).

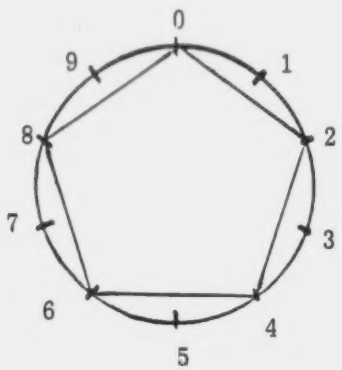
Let's begin by exploring an idea with which we are all familiar--the multiplication tables. If we think of the tables graphically, we probably picture them in a linear fashion.



Look what happens, however, if we work with a circular number line and connect only the units digits? Suddenly we have a whole new way of seeing and thinking about something which had probably become so familiar that we had ceased to see or think about it at all.



1-TABLE



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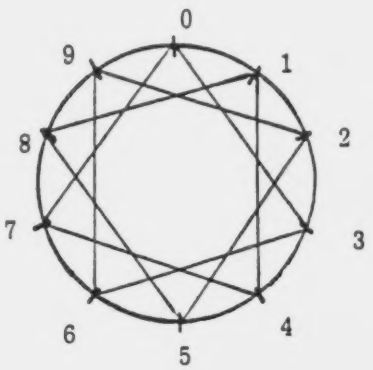

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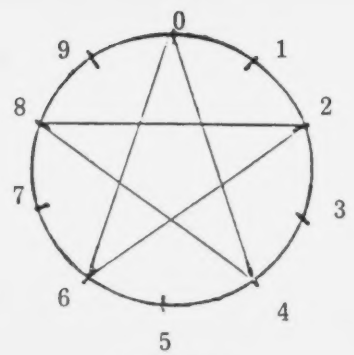

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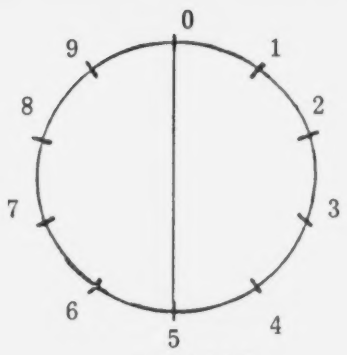
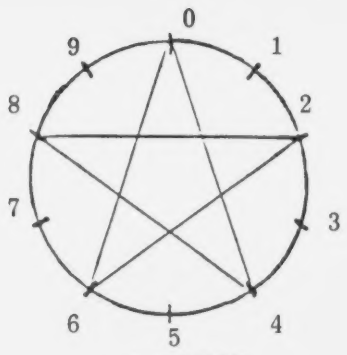
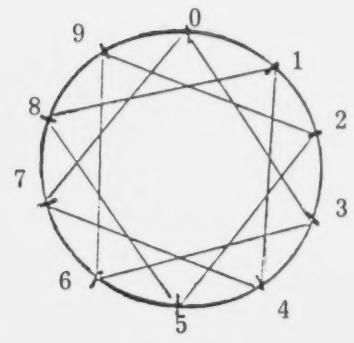


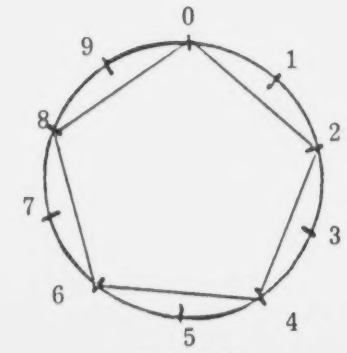
5-TABLE



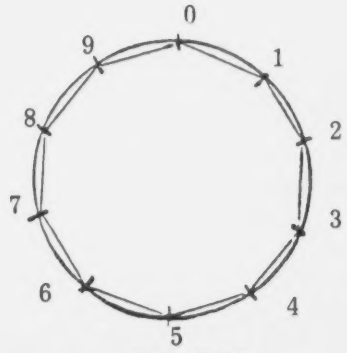
6-TABLE



7-TABLE



8-TABLE



9-TABLE

We notice patterns, some of which are similar to others. The 1-Table and 9-Table are similar, as are the 2-Table and the 8-Table, the 3-Table and the 7-Table, the 4-Table and the 6-Table. The 5-Table stands alone in its simplicity. What makes some tables similar? What is different about those that are similar? Based on the complexity of the patterns, would it seem easier to learn the 2-Table or the 3-Table? Why?

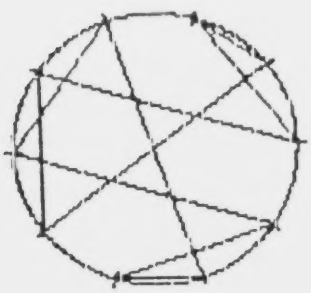
An inspection of the procedures used to draw the circular number lines and to connect the digits reveals that they are complex.

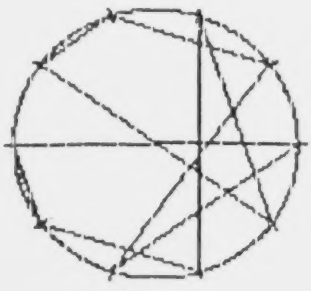
```
TO CIRCLE.MARK.CONNECT  :NUMOFPTS
 :EVERYNTH
CIRCLEANDMARK   :NUMOFPTS
CONNECTUP (CREATORDERLIST :NUMOFPTS
 :EVERYNTH) :POSLIST
END

TO CIRCLEANDMARK :NUMOFPTS
MAKE "PNUM 0
REPEAT :NUMOFPTS [MAKE "PNUM
 :PNUM + 1 REPEAT LENGTH [FD 1 RT 1]
 MARK]
END

TO LENGTH
MAKE "L (360 / :NUMOFPTS) * :PNUM
REPEAT (360 / :NUMOFPTS) * (:PNUM - 1)
 [MAKE "L   :L - 1]
OUTPUT  :L
END
```

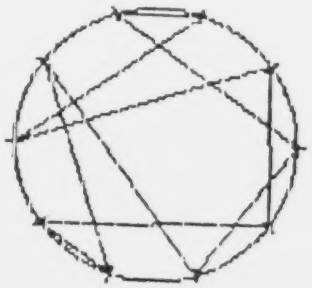
```
TO CONNECTUP  :ORDEROFPTS  :LOCOFPTS
IF :ORDEROFPTS = [] [STOP]
MAKE "COORDS PLACE FIRST  :ORDEROFPTS
 :LOCOFPTS
SETPOS  :COORDS
CONNECTUP BUTFIRST  :ORDEROFPTS
 :LOCOFPTS
END

TO PLACE  :N  :LIST
REPEAT  :N - 1 [MAKE "LIST BUTFIRST  :LIST]
OUTPUT FIRST  :LIST
END

TO CREATORDERLIST  :NUMOFPTS
 :EVERYNTH
MAKE "LIST [] MAKE "| 0
REPEAT  :NUMOFPTS [MAKE "| :|  + 1 MAKE
 "LIST LPUT MOD (:EVERYNTH *  :|)
 :NUMOFPTS  :LIST]
OUTPUT  :LIST
END

TO MOD  :A  :B
IF :A >  :B[OUTPUT MOD  :A -  :B  :B]
  [OUTPUT  :A]
END
```

If we are working with younger students whose logic is not sufficiently sophisticated to understand the procedures themselves, that does not preclude those same students using the procedures. CIRCLE.MARK.CONNECT has two variables, both of which are easily understood. The first variable is the number of points marked on the circle, and the second variable is the order in which those points are to be connected. CIRCLE.MARK.CONNECT 10 4 marks ten points on the circle and then connects every fourth point. Although many students might have difficulty writing the procedures themselves, few would have difficulty understanding how to use them. After students have explored 10-point circles, they can be encouraged to examine circles of 12 points, 18 points, and so on.

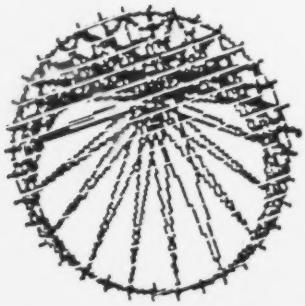
Connecting points on circles could also lead to an investigation of modular arithmetic. Here are some interesting designs resulting from the connection of points on specified rows of the Mod 11 Multiplication Table.

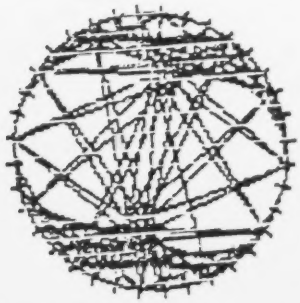






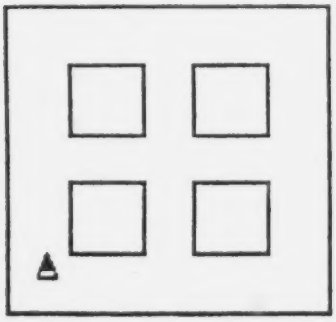
Connecting points on circles can also lead to Cardioid and Nephroid curves.





As we begin to see patterns and relationships, suddenly more patterns and more relationships begin to emerge. That's what happens in the exploration of important ideas. One question leads to another.

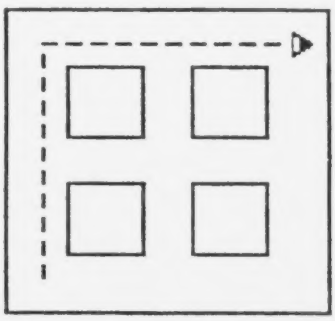
Let's examine another idea familiar to children and adults alike, the idea of mazes. Our maze is so orderly that it might better be called a grid, and the paths which we will explore are the shortest ones possible. Therefore, backtracking is illegal.

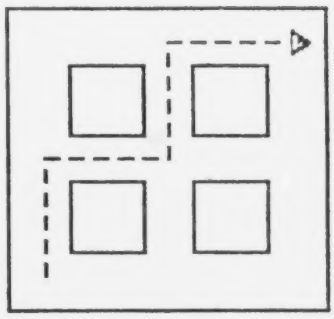


```
TO GRID
HIDETURTLE
PU SETPOS [-50 -50] PD
BLOCKS 2
BORDER
START
SHOWTURTLE
END

TO BLOCKS  :N
REPEAT  :N [SQUARE 30 PU FD 50 PD]
END

TO BORDER
PU SETPOS [-70 -70] PD
SQUARE 120
END
```

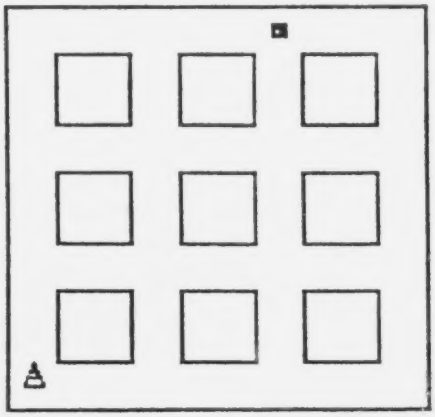
```
TO SQUARE  :SIZE
REPEAT 4 [FD  :SIZE RT 90]
END

TO START
PU SETPOS [-60 -60] SETH 0 PD
END

TO F
REPEAT 5 [PD FD 5 PU FD 5]
END

TO U
SETH 0 F
END

TO R
SETH 90 F
END
```

If we want to get from our position in the lower left corner of the grid to a position in the upper right corner, how many paths are possible? (Remember that we can only go up and/or to the right.) Here are two of the six possible paths: UURR and URUR.





The GRID procedure can easily be modified to include more blocks.



```
TO GRID2
HIDETURTLE
PU SETPOS [-50 -50] PD
BLOCKS 3
PU SETPOS [0 -50] PD
BLOCKS 3
PU SETPOS [50 -50] PD
BLOCKS 3
BORDER 2
START
SHOWTURTLE
END

TO BORDER2
PU SETPOS [-70 -70] SETH 0 PD
SQUARE 170
END
```

How many possible paths are there from the lower left corner to the spot on the grid?

As the grid is expanded and as the paths are explored, a pattern begins to emerge. By carefully studying the paths to every spot on the grid, we can begin to predict the number of paths without actually travelling each one. The number of paths to any given spot is the sum of the paths to the spot immediately to the left and to the spot immediately below the designated spot. Those more familiar with mathematics may recognize Pascal's Triangle among the paths. Suddenly we have stumbled into the wonders of probability!

Hopefully my point is beginning to be made through these few examples. Computers can certainly be used to help students think about important mathematical ideas and to better understand their own processes of conceptualization. They can also be used in some very ineffective and mundane ways that fail to argue their worth. The difference is determined by our choices of software, including languages like Logo, and by the quality of the questions which we are prompted to ask. Doubtless we will all need to undergo some retraining and some mental retooling to meet the challenges of computer technology. However, not all that we need to learn is new. Good teachers have always asked good questions. Computers simply demonstrate that attention to significant questions is more important than ever.

MATRIX ALGEBRA AND COMPUTER GRAPHICS

By: John W. McConnell, Glenbrook South High School, Glenview, IL

Twenty years ago, the School Mathematics Study Group issued a text on Matrix Algebra which was largely ignored by schools. Some work on matrices wiggled its way into advanced algebra and college algebra texts, but the content and approach featured in the SMSG text was dumped from the American mathematics curriculum in the "return to basics" movement.

I have taught a Matrix Algebra course at my school for 13 years. I find that the content and applications of matrix algebra warrant a serious reappraisal of the role of matrix algebra in the high school curriculum. Like many topics of the "new mathematics", which were dumped during the 1970's, matrix algebra is reemerging as a major mathematical tool for applications, theory, and problem-solving. The computer and calculator make matrix algebra a fundamental tool for understanding mathematics and for solving problems in diverse and varied fields. Matrix algebra should be a central focus of a mathematics course after geometry.

The great power of technology in the form of computers and calculators should change the mathematics our students encounter in high school in a variety of ways:

1. Technology should be used to teach concepts of mathematics.

2. Technology should be used to make applications of mathematics accessible to students.

3. Technology should be one of the driving forces in curriculum, helping to distinguish mathematics which students should really know from that mathematics which is in the curriculum because of tradition.

4. Technology cannot be used by students without explicit instruction: a strand in every math course should be "mathtech", or how to use calculators and computers to do mathematics.

If one examines contemporary mathematics textbooks, one finds a timid approach to technology. Computer and calculator exercises are tacked onto lessons and chapters where they may be avoided. The exercises do not teach more about applications; they do not teach about a mathematical topic; and they do little to teach about computers and calculators.

I would argue that we are now at a time in American mathematics education which calls for a critical revision of the mathematics content. It is not sufficient to add computer and calculator to existing curricula. We need to pick better topics and perform more intelligent integration of technology into our classrooms. I believe that matrix algebra should play a primary role in our rethinking of content priorities.

I have had the opportunity in my school to run my matrix algebra course in a nonrestrictive fashion. I was impressed in my college and graduate work on the importance of matrix algebra (and statistics) as being the major mathematics areas which were used by different departments in a university. When I started teaching the matrix course, I was further impressed by the

scope and breadth of our textbook, Philip Davis's The Mathematics of Matrices. When that went out of print, I scrambled to do my own materials. In 1984, I wrote the first attempt at a text integrating matrices and computers. After working with the University of Chicago School Mathematics Project Algebra in Summer, 1985, I threw out my old notes and tried to restructure the course in the Chicago mold. (Please note that this course was not developed by the Chicago project and is nowhere near the quality produced by their writers and staff.)

The UCSMP approach to textbooks has been guided by the director of the 7-12 grade component of the project, Zalman Usiskin. Usiskin has set content and pedagogical goals for each text in the UCSMP series. Each text is to respond to major curricular goals set by national study groups: there is to be a revision of content based on new technology; geometry is to be taught throughout the series; statistics and probability are to be included from the seventh year on; applications and problem solving are to be in every unit. Usiskin focuses on four major avenues to learning: skills, properties, uses, and representations. Skills is the traditional, manipulative approach; properties is the "new math" approach; uses are the applications so lacking in today's texts; representations are the interpretations of mathematics in different guises. Usiskin believes that these four avenues are indeed different dimensions of learning. Students may be better at learning a topic in one of the modes as opposed to the others; in any case, each dimension must be taught and practiced explicitly.

In addition to the four dimensions expressed above, the Chicago materials are written in a distinct style. Each lesson is intended to be one day's work. The text and examples are to be read by the student. No paragraph or example is written without a corresponding exercise for the student. The exercises fall into three parts: covering the reading, applying the reading, and review. Covering the reading questions guide the students through the text. Applying the reading are direct, simple applications of the concepts of the lesson. Review exercises look backwards at important concepts from previous lessons and chapters. The review exercises include drill, applications, and properties. They are varied to present opportunities for all students to find problems which they can do in the homework. Each chapter concludes with a review which has problems organized about objectives. The objectives are grouped by skills, properties, uses, and representations. About two days are spent on each review. Chapter tests are patterned after the review.

Because these materials, like the Chicago materials which are being field-tested, require students to think, tests are harder than ordinarily found in American mathematics classrooms. A student who gets 80% on tests, for example, is certain of a grade of A.

Here is the outline of my matrix course as it currently stands. (A detailed outline of the course and the final exam can be acquired from me directly.)

1. **Introduction to Matrix Algebra**
   Most of the students have seen matrices in advanced algebra, the prerequisite for this course. This introductory chapter focuses on writing matrices, identifying elements, the properties of addition, using matrices in business and in geometry, representing matrices in Pascal, special matrices such as symmetric and diagonal, and special operations such as the transpose.

2. **Operations with Matrices**
This chapter opens with matrix multiplication. A theme running through three sections are problems which may be interpreted through matrix multiplications. Scalar multiplication, properties of multiplication, and matrix polynomials lead to two sections on symmetries of the square. These sections, which would be child's play for students coming from a transformational geometry course, build a mathematical system of operations which will be represented by matrices in chapter 4.

3. **Inverses of Matrices and Their Applications**
Student experience with solving systems is extended with calculator work. At least half the problems in the book from this point on require some calculator work. Inverses are defined and inverses of special matrices are developed immediately. Systems are solved with row reduction and back-substitution in a formal manner. Calculator problems force the student to organize work. The systematic method is extended to finding the inverse of any matrix. The computer program REDUCE is used as a row reduction calculator; the program MATRIX is used for rapid computations with large matrices.

4. **Matrices as Geometric Transformations**
The symmetries of the square are interpreted as matrices. Reflections are generalized to 3-D. Conic sections are transformed with matrices. A general rotation matrix is defined and used to develop the fundamental trigonometric identities for sine and cosine.

5. **Composites of Matrix Transformations**
Reflections in an arbitrary line are represented as a product of three matrices. Translations are introduced with homogeneous form for coordinates. Projections are introduced. Transformations are again generalized to 3-D. Determinants are introduced as a way of finding areas of polygons.

6. **Vectors**
This chapter shows how vectors can be represented by matrices. The angle between two vectors becomes a major application in 2,3, and more dimensions. Eigenvalues and vectors are introduced from a transformation perspective.

7. **Computer Graphics**
Lessons in this chapter are introduced as needed in the previous chapter. They include an introduction to Apple graphics; introduction to the matrix graphics unit written for the course by Ward Eldred, a Glenbrook South student; programs on transforming geometric figures of progressive difficulty; and a program for displaying eigenvectors in the plane. Three-D computer graphics are introduced.

Since the focus of this conference is on technology, let me move through the outline of the course and indicate how computers and calculators fit with this 20th century mathematics.

1. Use of Pascal vocabulary for representing matrices and loops (Chapter 1).
2. Use of computer program to do row reduction (Chapter 3).
3. Use of calculator for row reduction (Chapter 3).
4. Use of calculator for trigonometry (Chapter 4).
5. Use of computer application for screen graphics (Chapter 5).
6. Determinants and calculator (Chapter 5).
7. Angle between two vectors--applications requiring calculator (Chapter 6).
8. Transformations of geometric figures through computer programs (Chapter 7).
9. Computer graphics program to demonstrate eigenvectors.

The emphasis on skills, properties, uses, and representations in this course could not have been possible in a traditional mathematics course. Too much content in mathematics courses is purely skill and symbol oriented. Attempts to attach technology to these topics are doomed to failure. The matrix algebra provided a theme for a course rich in properties, applications, and uses. Topics were selected in part because technology had made them important or because technology had made them accessible. Technology in the form of calculators and computers was taught explicitly with the mathematics which used technology.

When I was doing my graduate work at Northwestern University, I was impressed by the computer center's role as a center where researchers from all subject areas came together, rubbed elbows, and found that they needed some common mathematics to solve their problems. That mathematics, which the computer had brought to the forefront, was dominated by matrix algebra (and, of course statistics). I have always enjoyed teaching matrix algebra because I know that many of my students will use it in their further studies. But until the last two years, I have taught the course as an enrichment course. It is now a primary mathematics course which I believe brings a broader conception of mathematics to high school students. Although it is difficult, although it requires thinking and reading, students emerge with a capacity to apply their mathematics unlike their peers in more conventional courses. For the final examination, I took a former examination and added applications. Before this year there were about 30% A's on the final; this year 60% earned A's, even though I moved the grading scale up 5 points!

This course still has considerable work before it ranks as publishable quality. It takes considerable time to revise curriculum, write lessons students can read, prepare exercises which are not repetitive drill, and organize computing materials which use technology wisely. It will take time through the next few years to test decisions on content and sequence. However, the current form of the course is sufficient to indicate it is both desirable and feasible to reform secondary mathematics curriculum around the technology of computers and calculators.

WHAT AP COMPUTER SCIENCE TELLS MATH TEACHERS ABOUT THEIR CURRICULUM

By: John W. McConnell, Glenbrook South High School, Glenview, IL

One of the problems of the current precollege mathematics curriculum is that it is designed to prepare students for calculus. The importance of calculus cannot be denied for the future engineer or scientist, but most of our high school graduates will go into areas of study or work which use mathematics differently from the calculus. The mathematics they may end up using will be more useful than the calculus. What is even more important, the mathematics that students will actually use may be teachable in high school. I am now in my third year of teaching AP Computer Science. I am impressed by that course as a mathematics course. The data structures, the procedural thinking, and the organization of Pascal represent very fine mathematics. The mathematics is not tied to the real number system as are most high school courses. The mathematics of computer science spans a richer domain of objects and transformations. In this paper I would like to play some mischief with mathematics curricula as I consider the question: What would the content of high school courses be if we targeted mathematical sequences at computer science rather than calculus?

There are six main parts to this paper. The first deals with mathematics topics which are important for doing computer science, which entered the curriculum during the "new math" era, and which were banished during the "return to basics". The second and third sections deal with units and topics which should be in the mathematics curriculum if it is to prepare students for computer science. The fourth section lists concepts which are considered to be important, but which would not be included in a curriculum leading to computer science as currently conceptualized by the Advanced Placement syllabus. The fifth section lists some topics which could be removed from current mathematics courses to yield some time for new work. The final section presents an argument that computer science has a place in the general education of college-bound students.

The new mathematics introduced many topics into the high school mathematics curriculum for logical and pedagogical reasons. Some of these topics include Boolean algebra, symbolic logic, sets, and number bases. During the "return to basics" movement of the 1970's, these topics were dumped. Yet these are topics which are very important to working in computers and which now have a claim to a place in schooling as useful mathematics. In fact, the rise of spreadsheets and data bases make the elements of symbolic logic and sets appropriate for the general education of students. They are topics important for all students, not just for the college-bound. Here are some other topics which have appeared in mathematics, but are currently deemphasized: functions, probability, counting (permutations and combinations), mathematical induction, and summation notation.

Computer science demands that some new topics receive emphasis equivalent to at least a unit of study. These include random events and simulations, matrix algebra, statistics, vectors, numerical analysis, algebraic and geometric transformations, counting, games and strategies, trees and directed graphs for organizing information, inclusion/exclusion, and doing things in order (queues and stacks). Some of these topics, like matrix algebra and vectors are easy for mathematics teachers to accept. The idea of using a simulation to solve a

problem, and the reasoning underlying statistics, are foreign to most mathematics teachers. It would take extensive inservice to incorporate these in the mathematics curriculum. Geometric transformations deserve a greater role in mathematics. Functional thinking is a general education skill which transcends computer science. Students should experience functions in which the domain and range are not real numbers. Geometry provides a unique environment for that study.

Here are some topics which should be included in the computer-literate mathematics curriculum: transitivity, composition of functions, recursion, arrangements of data, study of exceptional situations, labels and addresses, estimation, powering, polynomial approximations, convergence and limits, studies of efficiency, advanced interpolation, multiple step operations, bisection methods. Again, some of these topics would be easily accepted by mathematics teachers. Most teachers, for example, emphasize exceptional situations in the study of rational expressions such as $1/(x-3)$. Some of these topics would enhance traditional topics. For example, the study of trigonometric identities could be motivated by efficiency studies. "If computing a sine or cosine takes 10 times as long as a multiplication, and a multiplication takes five times as long as an addition or subtraction, which of the following will be computed faster, $\sin(3x)$ or $3\sin x - 4\sin^3 x$?" Some topics should replace similar content. For example, the work with synthetic division in many advanced algebra courses takes time which would be better spent on calculator and computer solution of polynomial equations. The time spent on Cramer's rule would be better spent on Gaussian reduction as a technique for finding solutions to systems and inverses.

The AP Computer science curriculum is weak in three areas. If it drove the mathematics curriculum, we would find courses lacking graphing of functions, 3-D geometry, and computer graphics. It is sad to note that most college professors with whom I have discussed curriculum agree that the first two topics are very, very important for calculus. Yet college tests do not emphasize those topics; high school textbooks give them only nodding attention; and teachers push them aside in favor of the manipulative skills which dominate our courses. Ironically, then, we have two topics which should be important for calculus neglected even with calculus at the apex of our curriculum! We could not do worse with computer science. The computer graphics issue, however, is one which bothers me very much. I believe that computer graphics are a significant representation of transformational geometry. In fact, I would argue that computer graphics give the student the same tool for geometry as a calculator gives him for arithmetic. Further, graphics assignments promote the structure and organization which should be an essential foundation of programming. I find that this omission from the AP curriculum is a serious deficiency.

Mathematics teachers who have read up to this point will be saying, "Yes, that is all good stuff, but where does it go in the curriculum? There isn't enough time to cover the material as it now stands." There are many topics and techniques which could open up instructional time. Dropping them will take courage. The geometry course can give up large-scale axiomatics and weird and wonderful circle theorems. Today's emphasis should be on <u>local deduction</u>; i.e., do you have enough information to solve a problem. This is typical of computer programming: you must establish a small environment which has sufficient procedures and data types to solve a problem. You do not have to reestablish all of computer science when you write a program! Circle theorems

are nice, but they take up time which could be used for more urgent mathematics. Extensive algebra manipulations could be removed from the curriculum. Computer programs already exist which do manipulation quicker and better than highly trained mathematicians. Therefore, the need for an individual to reach the calculus level of manipulative proficiency is gone. Cramer's rule, determinants as expansion by minors (as opposed to the determinant as product of pivots in Gaussian reduction), and logarithms for computation are topics which no longer belong in the curriculum. But even bigger gains can be achieved through two major steps in instruction: First, start algebra and geometry in grades seven and eight; second, delete the reviews which start many mathematics courses. The algebra and geometry which should be taught in the junior high school years does not need to be the same as that currently taught in the high school. In fact, it is best if it is not the same. THe content should feature graphing of functions, algorithms for solving equations, probability, statistics, fundamental geometric properties and theorems, applications, and programming with emphasis on developing the concept of variable. Much of what is taught to the average seventh and eighth grader is repetition of arithmetic skills. A typical eighth grade book introduces no new ideas or thinking until the middle, if then. Why develop skills which are better done on a calculator? It is time to open up the full 7-12 curriculum for meatier and more useful content.

At the beginning of this paper, I suggested making mischief with the curriculum by replacing calculus with computer science as the focus of secondary school mathematics. I would now argue that computer science belongs in the curriculum because it contributes more to the general education of students than many well--entrenched traditional courses. There are at least five reasons computer science is important: applications, problem-solving, local deduction, development of knowledge systems, reading and writing.

A good computer course will expose a student to a broader range of applications than any other course. I have been delighted with the applications which appear in most of the computer science books I have read. They cover diverse fields, therefore broadening the student's perception of how computing and mathematics is used in the world.

The AP Computer student must constantly verify the reasonableness of his results. The AP course requires substantial problem-solving. The student is constantly challenged to reexamine algorithms and data structures to solve problems.

The important skills of local deduction are developed. The computer provides an operational check on the student's logic and sequencing. Local deduction is a part of a great virtue of programming. Computer programming is creation of knowledge. The student must create objects (data structures), which have properties related according to rules (procedures and functions), and which are made up of primitives. Unlike geometry, which is a logical system in which the student must come up with centuries-old ideas according to a very complete set of axioms, computer science gives the student the freedom to invent new and better objects and rules. The computer science student has the opportunity to create knowledge, unlike the mathematics student who must absorb knowledge.

Finally, computer students must read and write. The reading which is required in AP Computer Science is a different kind of reading than that found in most

other courses. First, it is random access reading. When the student has a program to run, he usually must consult a variety of books. The techniques he needs just as likely might be at the end of a book as well as at the beginning. Contrast this with a typical textbook, particularly in mathematics: the student is not permitted to use a theorem on page 400, even if he is on page 390! Textbooks are typically morbidly sequential. Computer science books differ from textbooks in another significant way: they are readable. Most computer science books state problems, examples, and solutions in a clear and forthright manner. Most mathematics books do not. Students do not read math books; students do read computer science books. Finally, there is a significant difference between a mathematics course and computer science course. CS students must write. They must make their ideas clear in the coding of a problem and in their comments. The importance of this quality of computer science is reflected in this quote about the great computer scientist Donald Knuth:

> ...he takes the position that "good programming is...an inherently creative act" and "the best way to program...is really to concentrate on explaining to a person what the computer is supposed to do rather than explaining to a machine what it's supposed to do. That's my new hobbyhorse, to say that people should think about the communication of the program while writing it."

The AP Computer Science exam writers have taken a great step towards a generation of computer scientists who can communicate by targeting one of the questions on the AP test to analysis and discussion of a problem rather than programming a solution. This is, of course, a great difference from the kind of demands made upon a typical mathematics student.

Despite the demonstrated effectiveness of computers in language, in writing, in computation, and in problem solving, teachers at all grade levels resent the time and money it takes to do a good job educating students to use computers. As a result, teachers, administrators, and boards of education ask for more justification from computer educators than they ask of other educators. The questions they ask should be applied to all subject areas. The field of computer science should make us rethink the content and sequence of our curriculum. Technology does change the way we solve problems, communicate, and think. It is time that every subject, not just mathematics, has to measure traditional knowledge and skills against those required for a technological society. With the technology of computers gracefully accepted by mathematics educators we might be on the way to the prospect described by E. W. Dijkstra:

> Posing as a respectable scientist, I should abstain from crystal gazing in public, but I do see the possibility of a fascinating future in which the quality of the work of the computer scientists and of the mathematicians will be an order of magnitude better than it is now. It is a future in which we don't only agree that mathematical elegance is important, but will also teach its conscious pursuit. It is a future in which we don't only agree that a good notation helps, but in which we actually teach how to design notations that are geared to the manipulative needs at hand. It is a future in which programs will display all the beauty of a crisp argument, and in which the dictionaries will no longer define mathematics as the "abstract science of space, number, and quantity" (Concise Oxford

Dictionary) but as the "art and science of effective reasoning."

REFERENCES

Dijkstra, E.W., "On a Cultural Gap," The Mathematical Intelligencer, Vol. 8, No. 1, 1986, pp. 48-52.

Weiss, Eric A., "The Permanent Software Crisis," in Abacus, Fall, 1985, p. 49.

INTERFACING MICROCOMPUTERS TO THE REAL WORLD

By: Richard D. Miles, Southern Illinois University School of Medicine, Springfield, IL

INTRODUCTION

This paper deals with using the Apple II microcomputer and various inexpensive sensors to monitor parameters such as temperature, vibrations, light levels, and position. The computer can also be used to turn on AC or DC powered devices such as light emitting diodes, 60 watt light bulbs, and stepper motors.

INTERFACE SLOTS

There are eight interface slots in the back of the Apple, seven of which can be used for general interface circuits. These slots have 50 card-edge contacts which provide all of the address, data and control lines necessary for most interfaces. These slots can be used for analog-to-digital converters, digital-to-analog converters, parallel and serial interfaces. Commercial sources for these circuit boards can be found in many computer magazines. Analog-to-digital interfaces for the Apple are available from John Bell Engineering. These devices are under $100 and provide 16 channels of analog input. Temperature sensors such as the National LM335 can be purchased for under $2 and connected (as described in the sensor literature) to an A-D converter producing a temperature probe.

GAME CONNECTOR

The Apple computer has a 16 pin game I/O connector on the mother board. The Apple Reference Manual contains a function diagram of the connector. On this connector there are three pushbutton inputs, PB0-PB2, which accept and can interpret binary information either +5 volts or 0 volts (ground). There are four annunciator outputs, AN0-AN3, for controlling outside devices. These annunciators produce nominal +5 volts or 0 volts to turn external devices off or on. Also on the game connector are the game paddle inputs, GC0-GC3 which act as analog-to-digital converters. Also available at this connector is a software controllable strobe signal, +5 volt power, and ground.

GAME ANNUNCIATOR OUTPUTS

These four outputs on the game connector can be used to turn devices on and off. Voltage output from the annunciators can take on one of two values:

High (above 2.4 volts [typically 3.4 volts])
Low (below 0.4 volts [typically 0.2 volts])

The outputs can drive other TTL (transistor-transistor logic) integrated circuits with a 400 microamp source current and an 8 milliamp sink current. What this means is that they are good for connecting to other TTL ICs but not for direct connection to high voltage devices. For this we need an interface which can handle higher current and voltage. These devices would typically be relays or optoisolators. Optoisolators can often be driven directly from the annunciator outputs, but other devices, like relays, require a transistor for additional current or voltage drive. A 2N3904 or a 2N222 transistor (costing a dime or so) would easily produce higher current for the relay. To use the transistor to control a relay, connect a 1/4 watt 10k resistor between the annunciator pin of the game connector and the base of the transistor, to provide the controlling current. Next, connect the emitter to ground and wire

the collector to one end of the relay coil (assuming the coil is listed at 5 volts and has a resistance of at least 100 ohms). The other end of the coil should be connected to the 5 volt supply provided at the game connector. Be sure this does not draw more than 100 ma from the 5 volt supply. If you are using a relay, a diode should be connected across the relay coil with the cathode towards the +5 volts end to bypass the current surge when the relay is switched. Now, to address the annunciator AN0, POKE 49241,0 to throw the switch on and POKE 49240,0 to throw the switch off. Page 130 of the Apple II reference manual describes these addresses. The relay can be used to switch either AC or DC, just remember to isolate and insulate the outside world wiring. Also, do not exceed the current or voltage limits of the relay.

An optoisolator uses an LED to control a triac which can switch AC or DC. There are no moving parts in this device so it should last a long time. The optocoupler gives complete electrical isolation between the computer and the device being controlled. It can also be used to control larger triacs with higher current capability.

GAME PUSHBUTTON INPUTS

There are three pushbutton inputs which can be used to signal the Apple an event is happening. The pushbutton input is just like throwing a switch. It is either on or off. To be in the <u>on</u> state the input voltage should be between 2.4 and 5.0 volts. For the button to be in the <u>off</u> state, the input voltage should be between 0.4 and 0 volts (never negative). To operate the devices as input switches, connect one side of a pushbutton through a 10k resistor to a 5volt source. Then connect the other side of the pushbutton switch to ground. When the switch is closed, the pushbutton will be grounded and when the switch is open, the pushbutton will be at 5 volts via the 10k resistor. PEEK(49249) will read pushbutton number one, as shown on page 131 of the reference manual. The value will read as greater than or equal to 128 if the pushbutton input is high (> 2.4 volts) and less than 128 if the pushbutton is low (< 0.4 volts).

Instead of a pushbutton or toggle switch, you can use a variety of other switches. For example, a mercury switch is activated when placed vertically and deactivated when tilted to 90 degrees. Vibration sensors are also switches which close momentarily when a vibration is sensed. Because the switch closing is on the order of 1 msec it may be necessary to capture the vibration with an electronic latch or flip flop such as a 4043 or 74LS279. Resetting the latch could be performed manually with a switch or by the annunciator output from the computer. A photo transistor and a LED could be wired so that blocking the light from the LED would turn the photo transistor off. Many of the above mentioned switches could be used to wire a computer operated burglar alarm system.

GAME CONNECTOR PADDLE INPUTS

The game connector is basically an analog-to-digital converter which uses 555 timer integrated circuit in the Apple as a variable delay flip flop. When you adjust a game paddle you are varying a resistance. This resistance sets the current that flows into the game connector connection. The higher the resistance, the greater the time delay. This is represented in the apple as a variable between 0 and 255 which can be obtained by using the BASIC statement X=PDL(0). A monitor subroutine can also be called at $FBIE to read the game paddle. This works by passing the number of the game controller (0 to 3) in the X register. The subroutine returns with the value of the paddle setting

in the V register.

Any variable resistor in the range of 0 to 150k ohms can be used for the game paddle. Resistance above 150k will cause the paddle value to remain at 255. It will not harm the computer in any way. One example would be a photocell whose resistance changes with the amount of light. Radio Shack has a photocell that changes in resistance from 0.5 megohms in the dark to 1.7 kohms in low light to 100 ohms in a bright room. To operate this device, connect one end to the 5 volt power supply of the game connector and the other end to a paddle input. A simple BASIC routine can be written to plot the light level as a function of time.

SUMMARY

When Apple Computer designed the Apple II and IIe they gave us (via the game controller) a very easy way to control external devices. Simple BASIC peeks, pokes and PDL(0) commands produce input or output signals. Simple experimenting with switches or LEDs are good places to start exploring the capabilities of your computer. Care should be taken so that the transistor-transistor logic electrical requirements of the annunciator and pushbutton controls are observed. Most of all though, isolate and insulate any 120 VAC power that you are controlling with the Apple. Radio Shack stores are good sources for parts. The books and articles described in the references section of this paper (especially Sargent's book) will get you a long way toward building your own circuits.

REFERENCES

1. Sargent, Murray, III and Shoemaker, Richard L. 1981. "Interfacing microcomputers to the real world". Addison-Wesley Publishing Co., Reading, MA.

2. Ciarcia, Steven A. 1984. "Build the power I/O system". Byte magazine. December, 105-118.

3. Sheingold, Daniel H. (ed) 1981. "Transducer interfacing handbook". Analog Devices, Inc. Norwood, MA.

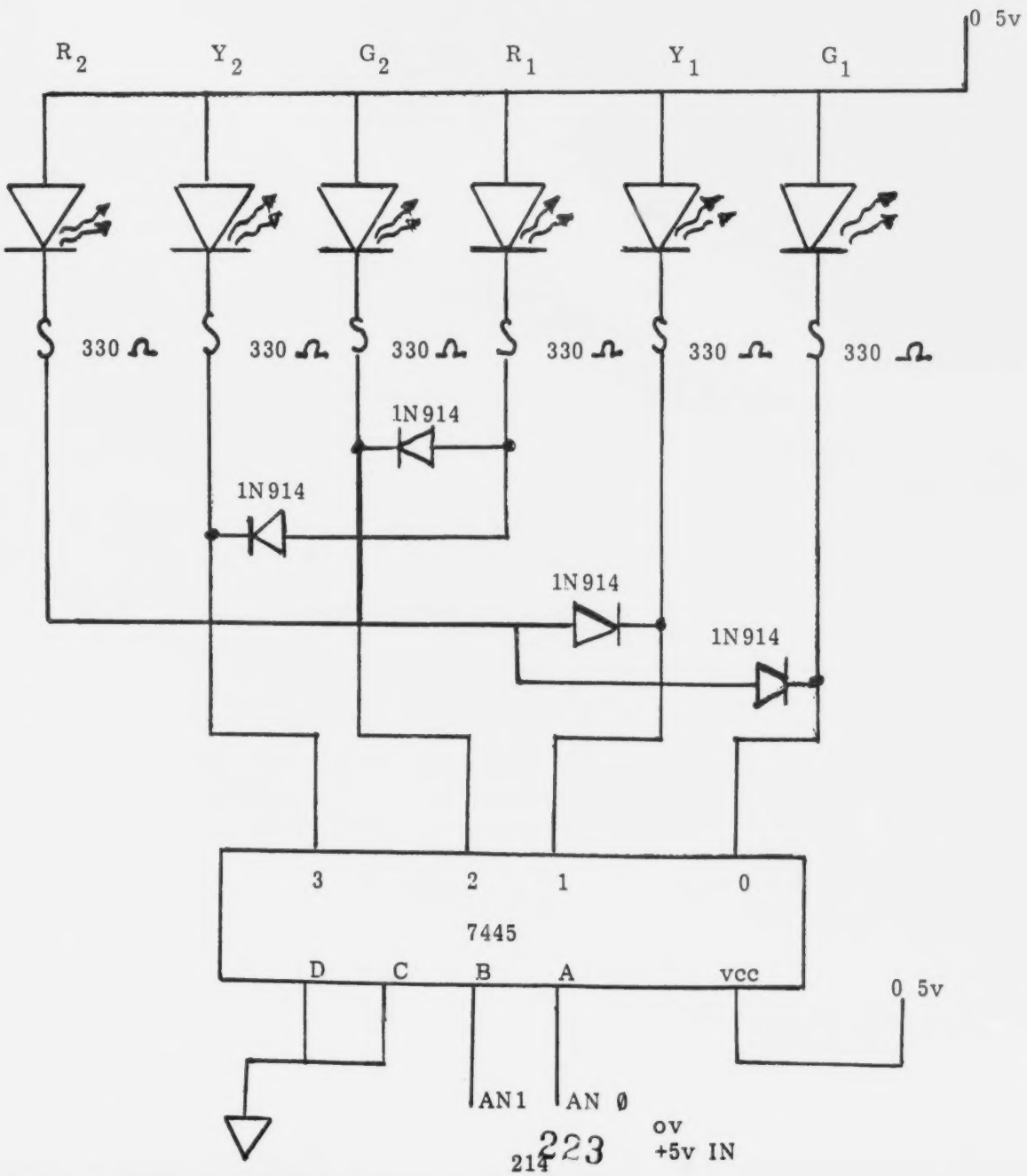
4. "Apple II reference manual. 1979. Apple Computer, Inc. Cupertino, CA.

5. Melen, Roger and Garland, Harry. 1982. "Understanding IC operational amplifiers", Howard W. Sams & Co., Indianapolis, IN.

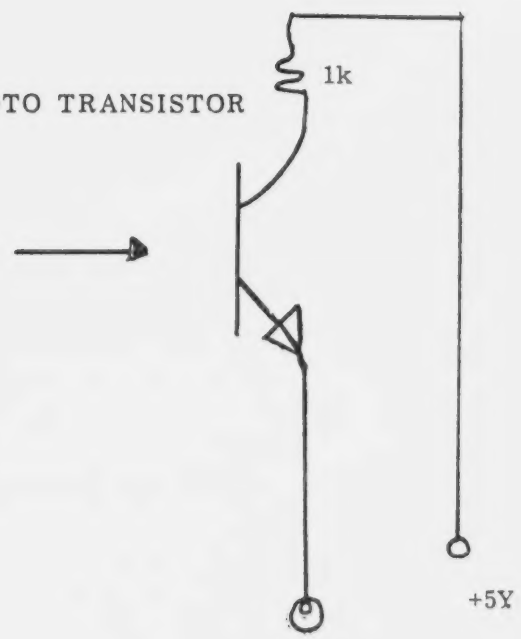
6. Lancaster, Don. 1981. "TTL cookbook", Howard W. Sams Co., Indianapolis, IN.

7. Filler. Aaron. 1984. "Apple Thesaurus", Datamost, Chatsworth, CA.

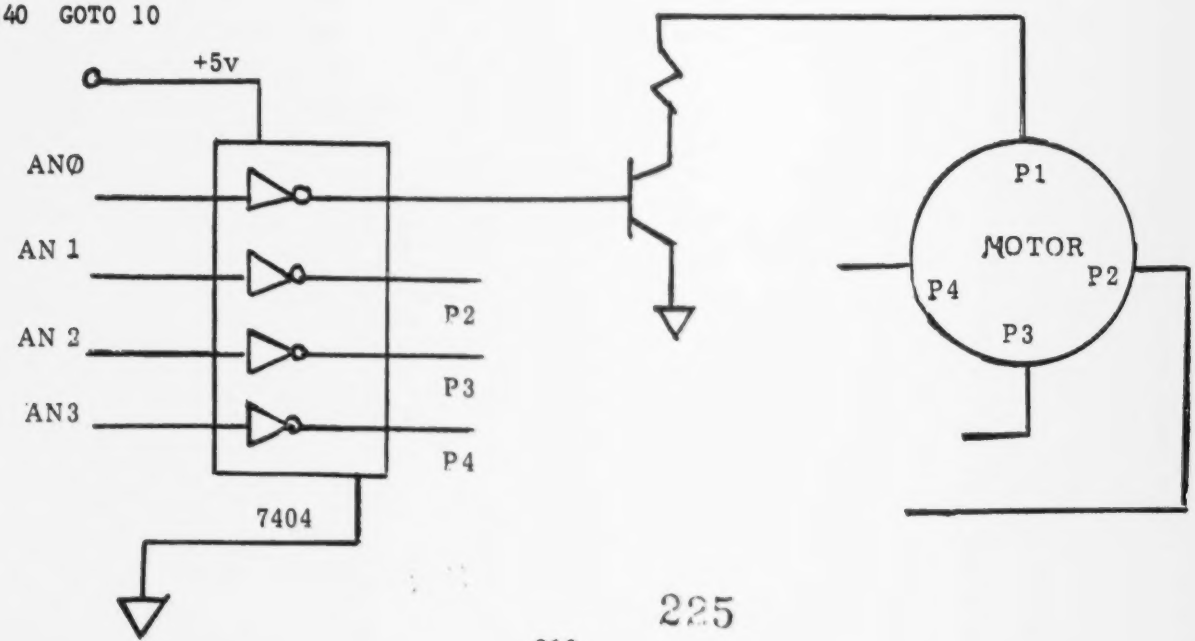
```
LIST

5   REM   TRAFFIC LIGHT
6   REM   R. MILES, 2-12-86
10  FOR T = 0 TO 425 STEP 3
15  IF T > 0 AND T < 125 THEN  POKE 49240,00:  POKE 49242,00
20  IF T > 125 AND T < 175 THEN  POKE 49241,00
25  IF T > 175 AND T < 375 THEN  POKE 49240,00: POKE 49243,00
30  IF T > 375 AND T < 425 THEN  POKE 49241,00: POKE 49243,00
35  NEXT T
40  GOTO 10
```



```
LIST

5   REM  PHOTO TRANSISTOR
6   REM  R. MILES, 2-12-86
10  HGR : HCOLOR= 7
20  FOR X = 0 TO 279
30  Y = PDL (0): IF Y > 150 THEN Y = 150
40  HPLOT X,Y
50  NEXT X
60  GOTO 10
```

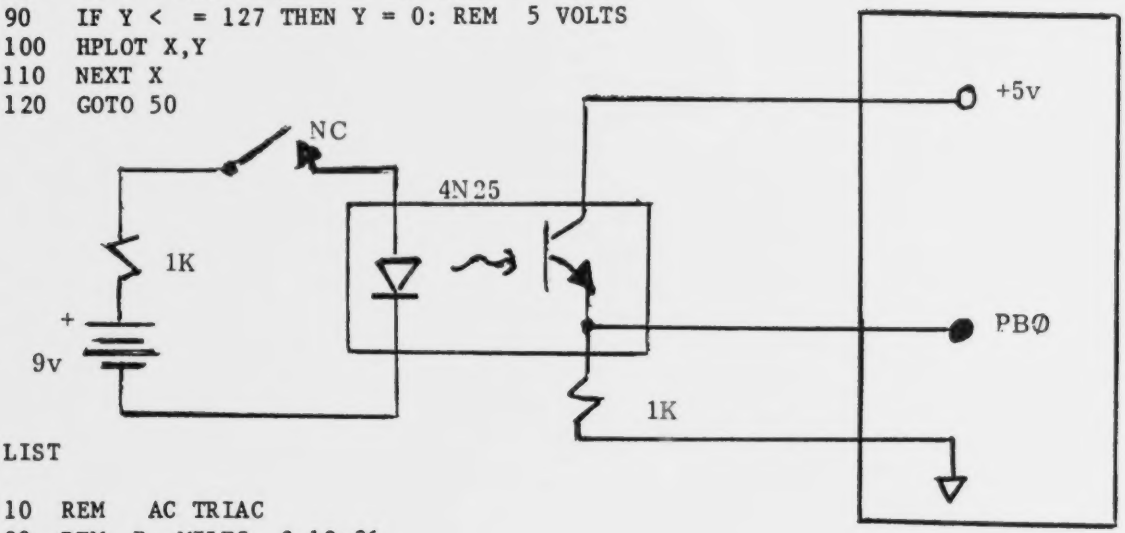


```
LIST

1    REM  STEPPER MOTOR
2    REM  2-12-86 MILES, BUTCHER
5    ST = 0
10   HOME
15   POKE 49240,00:  POKE 49243,00:  POKE 49245,00:  POKE 49246,00:  REM
     POSITION 4
30   INPUT " POSITION WANTED (0 TO 50)";N
32   IF N < 0 GOTO 30
33   IF N > 50 GOTO 30
40   D = N - ST:ST = N
50   IF ABS (D) > 25 AND D < 0 THEN D = D + 50
60   IF ABS (D) > 25 AND D > 0 THEN D = D - 50
70   IF D < 0 THEN D = ABS (D): GOTO 220
80   IF D = 0 THEN  GOTO 30
90   FOR I = 1 TO D
100  FOR P = 1 TO 4
110  IF P = 1 THEN  POKE 49241,00: POKE 49242,00: POKE 49245,00: POKE 49246,00
130  IF P = 2 THEN  POKE 49241,00: POKE 49242,00: POKE 49244,00: POKE 49247,00
150  IF P = 3 THEN  POKE 49240,00: POKE 49243,00: POKE 49244,00: POKE 49247,00
170  IF P = 4 THEN  POKE 49240,00: POKE 49243,00: POKE 49245,00: POKE 49246,00
190  NEXT P
200  NEXT I
210  GOTO 10
220  FOR I = 1 TO D
230  FOR P = 1 TO 4
240  IF P = 1 THEN POKE 49240,00: POKE 49243,00: POKE 49244,00: POKE 49247,00:
     REM  POLE                          3
260  IF P = 2 THEN POKE 49241,00: POKE 49242,00: POKE 49244,00: POKE 49247,00:
     REM  POLE                          2
280  IF P = 3 THEN POKE 49241,00: POKE 49242,00: POKE 49245,00: POKE 49246,00:
     REM  POLE                                  1
300  IF P = 4 THEN POKE 49240,00: POKE 49243,00: POKE 49245,00: POKE 49246,00:
     REM  POLE                          4
320  NEXT P
330  NEXT I
340  GOTO 10
```

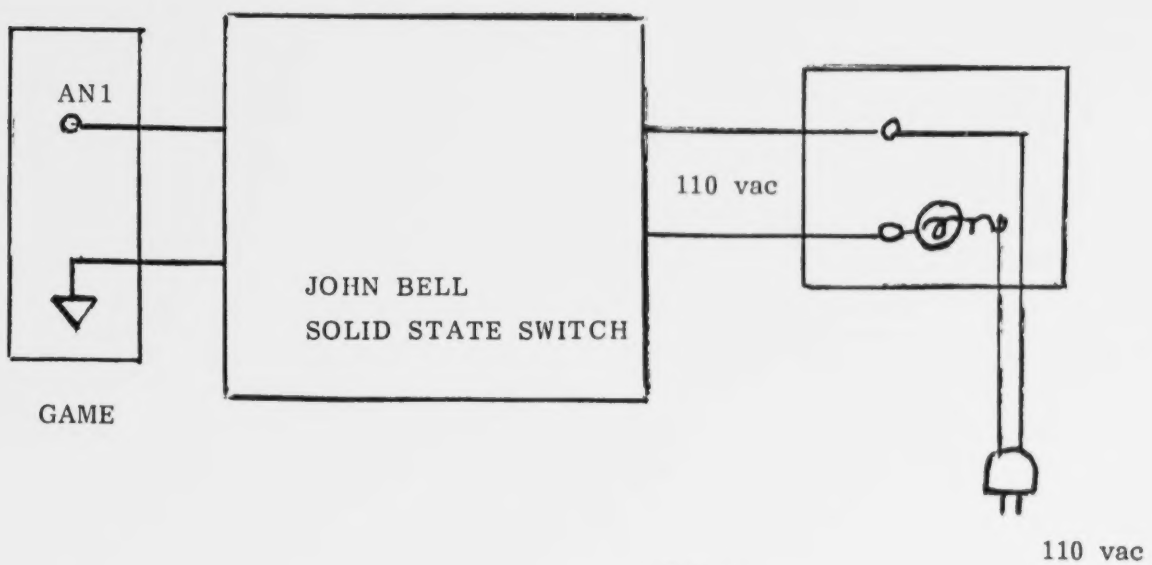


225

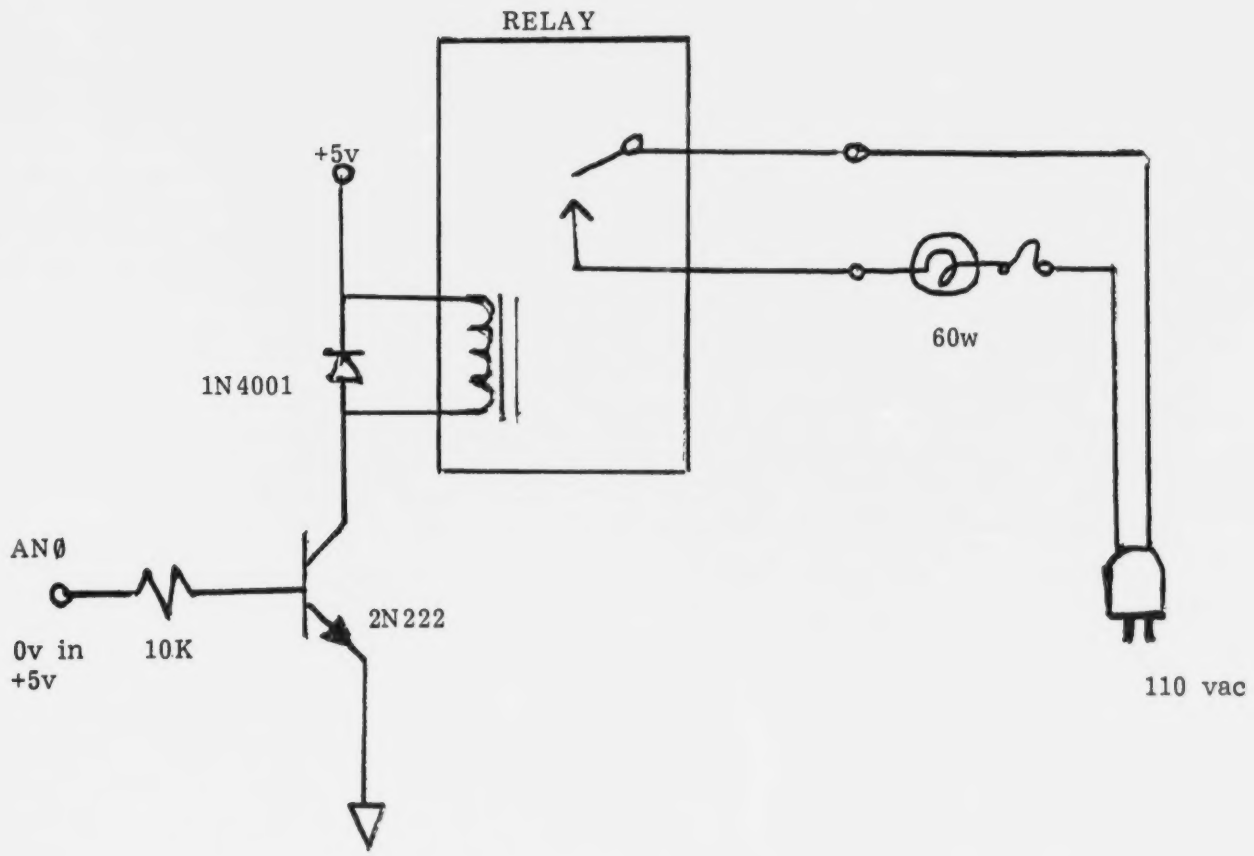
```
LIST

10   REM  MAGNET SWITCH DISPLAY
20   REM  PUSHBUTTON 0
30   REM  R. MILES, 2-12-86
40   REM
50   HGR : HCOLOR= 7
60   FOR X = 0 TO 279
70   Y = PEEK (49249)
80   IF Y > 127 THEN Y = 128: REM  0 VOLTS
90   IF Y <  = 127 THEN Y = 0: REM  5 VOLTS
100  HPLOT X,Y
110  NEXT X
120  GOTO 50
```




```
LIST

10  REM   AC TRIAC
20  REM  R. MILES, 2-12-86
25  GET A$:  PRINT "ON"
30  POKE 49243,0: REM  AN1 ON
40  GET A$: PRINT "OFF"
60  POKE 49242,0:  REM  AN1 OFF
70  GOTO 25
```



```
LIST

10  REM  AC RELAY
20  REM  R. MILES, 2-12-86
25  GET A$:  PRINT "ON"
30  POKE 49241,0:  REM   AN0 ON
40  GET A$:  PRINT "OFF"
50  POKE 49240,0:  REM   AN0 OFF
70  GOTO 25
```



THE MUSIC LOGO LANGUAGE

By: Karen M. Moran, Glen Ellyn, IL

Methods, insights, and conclusions from exploring the recently announced Music Logo language for three months with a normal fifth grade class will be presented. Developed by Jeanne Bamberger of M.I.T. and Terrapin, Inc., Music Logo is the same as Logo except that the graphics primitives have been replaced by music primitives. Also, Music Logo requires a nine voice music synthesizer, amplifier, and stereo speaker system.

Whereas graphics Logo provides a mathematical learning environment, Music Logo provides a music learning environment and lends itself to almost endless musical projects. For example, a CANONS command allows the student to compose and experiment with a four part canon. Another procedure provides the tools for a child to discover the effects of different basses (e.g., cowboy, blues, Oriental) on a melody of his or her own creation.

The most significant result of this three month experiment with Music Logo is that normal fifth grade students become composers at a level usually enjoyed only by college music students. With the power of the computer to assist them, the students create and listen to their own polyphonic compositions (canons), and their own ostinato bass compositions (soft rock). The children compose melodies in ABA form, and explore (again by way of the power of the computer and their own programming) the effects of style, tone color, rhythm, and harmony. In short, Music Logo supports the children as they build their own musical intellectual spheres.

In contrast, even children who have had private music lessons are rarely taught either composition or improvisation. Hence, private music students had no advantage in the learning of Music Logo. Furthermore, Music Logo does not use standard music notation and no performance skills are required; therefore, Music Logo allows every child to become a composer and to critically listen to his own music. (It was noted that in a PTA sponsored national contest, the only original music composition entries from this elementary school of 430 students were from the Music Logo classroom.)

Another important advantage of Music Logo is that two normally diverse curriculum areas, music and computer programming, can be simultaneously explored. Of prime importance is that Music Logo is a procedural language; hence, structured programming is being experienced at an early age. Students use up to three levels of nested procedures; they also learn file storage and retrieval, editing, booting, and computer technology.

As stated by Seymour Papert in Mindstorms: Children, Computers and Powerful Ideas, "the computer has the ability to change our relation to other kinds of learning" (p. 47). Because of Music Logo, the computer is now changing our relation even to the learning of music.

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WORDPROCESSING: A WINDOW ON THE WRITING PROCESS

By: Catherine Cobb Morocco, The Writing Project Education Development Center, Newton, MA

LD Children and Writing

For many of us, writing is a difficult and demanding task; for LD children, it is even harder. These children may write only a few words before "running out of ideas"; they have difficulty organizing and sequencing information and translating spoken ideas into writing; their script may be illegible to their teachers and even to themselves; their severe spelling and mechanical problems may continually interfere with composing (Deloach et al. 1981; Deno, Marston, and Mirkin 1982; Poteet 1979).

Writing is a prerequisite skill of paramount importance in the elementary grades, for it is the major vehicle students use to convey what they know in many different subject areas. Students need to master writing not only for proficiency in basic skills, but also for its effect on their self-esteem as they participate in school, at home, and in society.

The EDC Writing Project

Because of the limited amount of research on the uses of computers to teach LD children, EDC proposed in 1983 that OSERS fund a field-initiated study to explore this issue. We were motivated by several promising features of word processors as writing tools for LD elementary school students. Mostly anecdotal reports have suggested that they make the child's illegible script readable and more accessible for discussion and expansion. Word processors enable the child to manage mechanics by erasing and replacing words easily (Daiute 1985) and can stimulate collaborative writing activities (Leven et al. in press.) The EDC Writing Project was funded to advance our knowledge of how remedial teachers might apply this technology with LD children and to contribute to an emerging body of research on microcomputer applications for LD children.

In its first year (1984-85) the Writing Project conducted intensive observations in three Boston area school districts. The project documented the many different ways in which five resource room teachers used word processors to teach writing to LD fourth-graders, analyzing the specific techniques used to integrate computers into instruction. Eighty-five writing sessions were observed, ranging from fifteen to forty-five minutes in length. Project staff judged the "success" of computer applications by these criteria: the child's attention to composing, the number of words produced in first drafts, and the richness of first drafts.

Some teachers used the word processor in ways that stimulated LD students' engagement in composing. For example, one teacher showed a disorganized and discouraged LD boy that he could "start a story in the middle or even the end" on the computer, and gradually insert events in sequence. We observed others who intensified their students' difficulties with writing. For example, a teacher relentlessly used the "easy edit" features of the computer to have a child comply with the request for correct spelling, then punctuation, then capitalization, and finally the spacing of his name on the first draft of a short paragraph. The first boy appeared less anxious about his sequencing problem, continued writing vigorously, and was eager to print out his writing and take it home. The second child, in contrast, was visibly resistant, tired

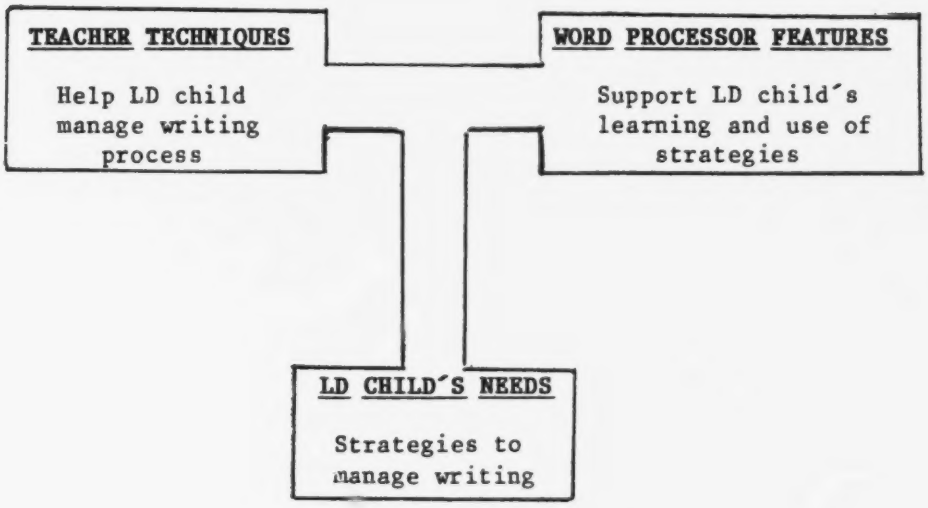
at the end of his computer work, and did not want a copy of his product.

MICROPROCESS: Its Potential for LD Children

The result of this kind of observation and analysis is that EDC is identifying a highly promising approach for the use of word processors for writing in remedial settings. The essence of the MICROPROCESS approach is that teachers integrate the computer with their knowledge of the LD child's needs and with principles of a process approach to teaching writing. Figure 1 illustrates the three elements of the MICROPROCESS approach. Each element is discussed below.

FIGURE 1

ELEMENTS OF THE MICROPROCESS APPROACH


TEACHER TECHNIQUES
Help LD child manage writing process
WORD PROCESSOR FEATURES
Support LD child's learning and use of strategies
LD CHILD'S NEEDS
Strategies to manage writing

LD Children's Writing Needs

MICROPROCESS focuses on LD children's skills in managing the writing process. Although LD childrens' mechanical and spelling problems often receive the most attention in remedial settings (Deloach et al. 1981), our analysis found that their writing also breaks down because they lack the strategies that more experienced writers have for managing the basic processes that recur in writing. These include, for example, finding and focusing a topic, anticipating audience needs, generating ideas, organizing information, expanding initial text, and applying writing conventions for such elements as punctuation. We also found that LD students were unable to manage their anxiety about writing. The "out-of-ideas" feeling comes frequently to LD children, who lack both the confidence and the repertoire of procedures that would enable them to generate another train of thought.

Teacher Techniques for Helping LD Children Manage Writing

MICROPROCESS integrates specific teacher techniques that are consistent with recent writing process theory and research. These techniques include asking the child to read his or her text, or having the teacher read the child's text aloud and encouraging the child to expand it ("What else would you like to

say?"), providing cognitive strategies for recalling information or generating ideas, simulating the audience's emotional response or informational needs. Our approach integrates general principles for teaching writing, such as having the child focus on composing in early drafts, and delaying editing until the text is complete, as well as maintaining the child's control of the writing content. These principles are consistent with the writing research which Graves (1983, 1985), Hauser, Newkirk, & Graves (1985) and Calkins (1981, 1983) have conducted at the elementary school level; and Flower and Hayes (Flower 1977; Flower and Hayes 1980, 1981; Hayes and Flower 1980), Emig (1977, 1978), and Murray (1968) have conducted at the adult level.

MICROPROCESS emphasizes teacher techniques that help the child manage the mental processes of writing. This goal is consistent with recent work in cognitive psychology or metacognition. That research suggests to them the ability to guide and control important cognitive strategies, differentiates more successful from less successful learners (Meichenbaum and Gilmore, in press) and learning disabled from their non-LD peer (Haynes, J. A. et al. 1984; Loper 1984; Thomas 1984).

Word Processor Features Which Can Help Teachers Apply a Process Approach

MICROPROCESS uses word processors to support many of the teacher techniques listed above. For example, the large print facilitates both the child's and the teacher's reading aloud the child's text. The public, upright monitor enables the teacher to suggest expansions without being intrusive, and the insertion feature enables the child to add new ideas without erasing or recopying. The computer gives the teacher a unique way to stay close to the LD child's writing process.

The practical goal of MICROPROCESS then, is to integrate these three elements in daily classroom writing activity. The situation described below is drawn from current observation data. It illustrates the intersection of these elements in helping a moderately learning disabled girl manage to write.

> Martha is dyslexic and has an above average I.Q., with a characteristic discrepancy between her WISC performance (108) and verbal (88) scores. Teacher ratings and IEP records suggest an imaginative, cooperative child who has difficulty concentrating, is disorganized, has extreme difficulty with spelling, and has awkward motor control during writing. As a result of all of these difficulties, teachers tend to assume that she is much less able than she really is. She spends five hours a week in a resource room and the rest in a mainstream classroom.

"YOU'RE THE AUTHOR"

> Martha is writing a story called "Tea at the Ritz." Although she has told the teacher a great deal about her experience, she is having difficulty getting started writing. She says that when she tries to write she can't think of what the Ritz looked like or what to describe first. The teacher suggests that she do a sketch of the tearoom with paper and pencil, labeling the important things in it. When Martha has done this, the teacher

has her sit at the computer and use the sketch like a map to guide her description. When she still hesitates, the teacher suggests that she "pretend you're talking to someone. You're telling them what it's like. Write what you would say to them." Martha types slowly but continuously for five minutes, taking her eyes from the computer only to glance at the map occasionally.

At one point the teacher observes her delete "deep red thick rugs" and retype "red carpits." The teacher reads the revised sentence aloud . . . says, "You can change it because you're the author." Because of these strategies for handling her spelling problem, the teacher previously helped Martha set up a computer file of some of her most frequently misspelled words in alphabetical order. Martha also uses a speller checker program once her description is ready for close editing. Martha does not have to be concerned about spelling while she is writing a first draft.

At the end of the writing period the teacher reads the opening sentence of Martha's description aloud and comments, "I love, `As I walk in . . .,' What a wonderful way to start telling us about the Ritz! File it and tomorrow we continue right here."

The teacher used several techniques to help Martha manage the composing process: she gave her a visual map strategy to help her recall and organize details and a conversational strategy to help her bridge the more familiar realm of oral introductions and the newer world of words on paper. The teacher had previously given Martha strategies for managing spelling so that it would not interfere with thinking and composing. She praised Martha's ideas, keeping the focus at this stage on composing. Finally, the teacher labeled Martha's revision process "something that authors do" to reinforce her overall purpose of helping Martha become more conscious of her own process and gradually develop a variety of ways to manage it.

The computer provided Martha with a writing tool that did not cramp her hand or distract her from developing ideas. It gave her an easy way to enter details from her map. The computer also allowed her to retrieve a correct spelling list for a later draft which made her misspellings easily visible, so that when her ideas were fully expressed, she could identify and correct them. It made Martha's revision process clearly visible, enabling the teacher to see that Martha was doing what all writers do. And, also extremely important is the fact that the computer enabled Martha to read what she was writing and the teacher, without being intrusive, to monitor her progress and praise her ideas. The result was that Martha was consistently involved in composing, and wrote a richly detailed first draft.

The example above concerns a girl who can already compose a good deal on her own if she has a strategy for getting started. MICROPROCESS also provides techniques that teachers can use with children who have severe difficulties with composing, and particularly children who "do not yet connect written prose with their own self-image" (Weir in press).

A Guide for Remedial Teachers

By spring 1986 EDC will produce a guide for remedial teachers entitled, MICROPROCESS Approach to Writing with Computers: A Resource Guide for Remedial Teachers. Designed to aid remedial teachers in using the approach in resource rooms and tutorial settings, the guide will discuss the principles that underlie the approach. It will also provide suggestions for identifying the writing processes most difficult for an individual child, specific techniques for integrating the computer into the learning program, and a series of sample lessons for the remedial setting.

EDC will train master teachers in Massachusetts to offer in-service training to others, and will distribute the guide in collaboration with the Massachusetts Department of Education, Special Education Division, and through several educational collaboratives in the State. It will make the guide available nationally to remedial teachers and specialists through information networks such as Special NET and Project RETOOL.

REFERENCES

Calkins, L. 1981. Children's rewriting strategies. Research in the teaching of English.

Calkins, L. 1983. Lessons from a Child: On the Teaching and Learning of Writing. Exeter, New Hampshire: Heinemann Educational Books.

Daiute, C. 1985. Writing and Computers. Reading, MA: Addison-Wesley Publishing Co.

Deloach, T.; Earl J.; Brown, B; Poplin, M; and Warner, M. 1981. LD teachers' perceptions of severely learning disabled students. Learning Disabled Quarterly, vol. 4, pp. 343-358.

Deno, S; Marston, S.; and Mirkin, P. 1982. Valid measurement procedures for continuous evaluation of written expression. Exceptional Children, 48, pp. 363-70.

Emig, J. 1977. Writing as a mode of learning. College Composition and Communication. 28 (2):122-28.

Emig, J. 1978. Hand, eye, brain: Some "basics" in the writing process. In Research on composing: Points of departure, pp. 59-71. Urbana, IL: National Council of Teachers of English.

Flower, L. 1977. Problem solving strategies and the writing process. College English. 39:449-61.

Flower, L. and Hayes, J. 1980. The cognition of discovery: Defining a theoretical problem. College Composition and Communication, pp. 21-32.

Flower, L. and Hayes, J. 1981. Plans that guide the composing process. In Writing: The nature, development and teaching of written communication, eds. C. H. Frederiksen and J. Dominic, p. 39-58. Hillsdale, NJ: Erlbaum.

Graves, D. 1983. Writing: teachers and children at work. Exeter: New Hampshire: Heinemann Press.

Graves, D. and Stuart, V. 1985. Write from the Start: Tapping your child's natural writing ability. New York: E. P. Dutton.

Hauser, J.; Newkirk T.; and Graves, D. (Eds.), 1985. Breaking ground: Teachers relate reading and writing in the elementary school. Exeter: New Hampshire: Heinemann Educational Books.

Hayes, J. R., and Flower, L. D. 1980. Identifying the organization of the writing process. In Cognitive processes in writing, eds. L. W. Gregg and E. R. Steinberg, pp. 3-29. Hillsdale, NJ: Erlbaum, 1980.

Haynes, J. A.; Kapinus, B. A.; Malouf, D.; and MacArthur, C. A. 1984. Effect of computer-assisted instruction on disabled readers' metacognition and learning of new words. Technical Report no. #101. Institute for the Study of Exceptional Children and Youth. College Park: University of Maryland.

Levin, J.; Riel, M.; Rowe, R.; Borutea, M. in press. Muktuk meets Jacuzzi: Computers networks and elementary school writers. In The Acquisition of written language: Revision and response, ed. S. Freedman. New York, NY: Ablex.

Loper, A. B. 1984. Accuracy of learning disabled students' self-prediction of decoding. Learning Disability Quarterly, 7: 172-178.

Meichenbaum, D., and Gilmore, J. B. in press. The nature of unconscious processes: A cognitive-behavioral perspective. In The unconscious reconsidered, eds. K. Bowers and D. Meichenbaum, New York: Wiley.

Poteet, J. 1979. Characteristics of written expression of learning disabled and non-learning disabled elementary school students. Diagnostique, (4), pp. 60-74.

Thomas, A. 1984. Microcomputer problem solving: styles and strategies of LD and average achieving students. Paper presented at the 1984 Annual Meeting of the American Educational Research Association, New Orleans.

Weir, S. (in press) Cultivating Minds: A Logo Casebook, New York: Harper and Row.

NATIONAL GOVERNORS' ASSOCIATION MEMO

TO: PEOPLE MAKING RECOMMENDATIONS TO GOVERNORS ABOUT EDUCATION POLICY

FROM: Joe Nathan. Coordinator of the NGA education project, "The 1991 Report"

The National Governors' Association has established 7 task forces to consider specific education reform policies and make recommendations in August, 1986. Each group has 6-8 governors participating, and will hold hearings at various places around the nation. A list of the task forces is given below.

Anyone interested can provide written testimony to the seven task forces. The most useful testimony will make specific recommendations about state policy and cite research supporting these recommendations. Testimony should be no longer than 5 typewritten pages or 2,000 words. It should be sent by February 1, 1986, to Carol Eliason at the National Governors Association, Suite 250, 444 North Capitol Street. Washington, D.C. 20001. Ms. Eliason will be glad to answer questions and can be reached at (202) 624-5300. The task forces are:

1. **Emerging Technology**: What state policies will lead to the most cost-effective use in schools of new and emerging technologies? New Hampshire Governor John Sununu chairs this task force, with Texas Governor Mark White serving as vice-chair.

2. **Teaching**: What can states do to attract and retain outstanding teachers? Chaired by Governor Tom Kean, New Jersey, with Governor Bruce Babbitt, Arizona as vice-chair.

3. **Parent Involvement and Choice**: How should states encourage parent involvement in and provide opportunities to choose from among schools? Colorado Governor Richard Lamm will chair this group, with Delaware Governor Michael Castle serving as vice chair.

4. **Readiness for School**: How can states improve young people's readiness for school, particularly youngsters from low income families? This task force is chaired by Governor Richard Riley, South Carolina. Vice-chair is Governor Dick Thornburgh of Pennsylvania.

5. **School Leadership**: What actions by states will encourage results-oriented school leadership? Chaired by Arkansas Governor Bill Clinton. Vice chair is Rhode Island Governor Edward DiPrete.

6. **School Facilities**: How can states make the most effective use of school buildings and facilities? Montana Governor Ted Schwinden will chair this committee. Utah Governor Norman Bangerter is vice-chair.

7. **College Quality**: What steps should states take to assess the amount of learning occurring at post-secondary institutions, and to share this information with potential consumers and the general public? Missouri Governor John Ashcroft is the chair, with Florida's Bob Graham the vice-chair.

The final recommendations will be issued in August, 1986. The NGA intends to issue a report card during the next five years assessing progress states have made in each of these areas.

CLASSIFICATION UPDATE: DEWEY 004-006

By: Charlene Orr, Maine Township High School East, Park Ridge, IL

004 DATA PROCESSING COMPUTER SCIENCE

Use 004 for generalities of data processing and computer science; selection and use of computer hardware and computer systems; and processing modes.

Use 621.39 for the engineering or manufacturing of computer hardware.

.015 1 Computer mathematics (formerly 519.4)

.019 Human-computer interaction
Include comprehensive works on psychological and non-psychological aspects of human-computer interaction

.11 Digital supercomputers

.12 Digital mainframe computers

.125 Specific digital mainframe computers

.14 Digital minicomputers

.145 Specific digital minicomputers

.16 Digital microcomputers
Personal computers, comprehensive works on minicomputers and microcomputers

.165 Specific digital microcomputers

.19 Hybrid and analogue computers

.2 Systems analysis and design, computer architecture, performance evaluation

.21 Systems analysis and design
Analysis of a user's problem preparatory to developing a computer system to solve it

.22 Computer architecture
The design and structure of the computer - and the computer in relation to its peripheral devices

.24 Performance evaluation
Performance measurement and evaluation to aid in designing or improving the performance of a computer system

.3 Processing modes

004.5 Storage

.53 Internal storage (e.g., random-access memory, RAM and read-only memory, ROM)

.56 External storage
Hard and floppy disks; tapes, cartridges, cassettes; tape and disk drives; optical storage devices; punched cards

.6 Interfacing and communication
Equipment and techniques linking computers to peripheral devices or to other computers

.64 Modems, optical-fiber cable, etc. : various hardware for interfacing

.7 Peripherals

.76 Input peripherals : card readers, keyboards

.77 Output peripherals : printers, monitors

005 COMPUTER PROGRAMMING, PROGRAMS, DATA

.1 Programming (writing instructions to direct the operation of a computer or its peripheral equipment)

.13 Programming languages

.131 Symbolic (mathematical) logic

.133 Specific programming languages

.136 Machine and assembly languages

.14 Programs that aid in debugging other programs

.15 Preparation of program documentation
Class program documentation with the program in 005.3
Class effective technical writing in 808.06 (paragraph structure, organization for clarity, use of active voice)

.2 Programming for specific types of computers

.26 Programming digital microcomputers

.3 PROGRAMS
Software and programs on microchips (firmware)
General concepts: history, description, critical appraisal, selection, use
Application programs (programs designed to teach, entertain, or perform other tasks for users) and software documentation

.329 Specific programs
Class here programs having interdisciplinary applications, such as electronic spreadsheets (useful in research, business, personal finance - anytime a matrix format is needed)

.36 Specific programs for digital microcomputers

PLEASE NOTE:

I. Class computer software by subject content

II. Multiprogram files (items that have multiple topics) : class with the topic that receives the most emphasis

A. Emphasis may be a matter of application of one subject to another

e.g., the application of computer technology to writing instruction will be classed with writing instruction

B. For 2 subjects: class the file with the subject listed first when there is no emphasis or preponderance of either one

e.g., a file with programs that deal equally with football (796) and swimming (797) would be classed in 796, the first-listed topic

C. For several topics that are part of a broader topic:

e.g., drawing, decorative lettering, needlework, and glasswork would be classed in 740 since all of the topics are part of the broader topic

D. For several topics that are not part of a broader topic:

Use the 080s (General collections)
030s (General encyclopedic works) or
050s (General periodicals), or choose
005.3 (Collections of programs, systems of interrelated programs, individual programs having interdisciplinary application)

005.43 SYSTEMS PROGRAMS OPERATING SYSTEMS

Utility programs: systems programs that perform housekeeping tasks. They do not directly perform user's tasks, but enable a computer and its peripherals to operate so that the user's programs will work.

e.g., ProDOS
M/S DOS
CPM
Apple DOS

.74 Data base management system
"Class in 005.74 computer-science aspects of databases--that is, the narrowly technical issues of designing, programming, and installing databases and database management systems--the kinds of things that system designers and programmers need to know but that users generally do not need to know..." (004-006 Data Processing and Computer Science..., p. 39)

.8 Data security (Access control)

006 Special computer methods
Programs, programming, selection and use of hardware for special computer methods such as artificial intelligence and computer graphics

.3 Artificial intelligence (formerly 001.535)
Use of computers for solution of complex problems involving reasoning; study of computer techniques to supplement the intellectual capabilities of human beings.

.4 Pattern recognition (Includes bar-code scanning and and scanners)

.5 Sound synthesis (use 789.99 for computer music)
A sound synthesizer, attached to the computer, acts on signals from the computer and can put sounds together to make words as well as music.

.6 Computer graphics
Class here comprehensive works on computer graphics and computer sound synthesis.

.62 Hardware
e.g., graphics terminals, plotters. Class works that treat equally the use of equipment for graphics and non-graphics tasks in 004.

.66 Programming computer graphics (including languages).

.68 Programs

MISCELLANEOUS TOPICS AND THEIR NUMBERS

Computer-aided manufacture	670.427
Computer art	760
Computer-assisted instruction	371.394 45
Computer games	
A. Class educational games with the appropriate subject, e.g.:	
Math games	513
Geography of United States	917.3
B. Games designed for entertainment, e.g.:	
Electronic games	794.8
Computer games (e.g., Pac-man)	.82
Athletic and outdoor sports and games: e.g.: computerized baseball 794.86357	.86-89
C. When in doubt if a game is educational or recreational, use 794.8s.	
Computer operations in office services	651.8
Data processing in management	658.05
Engineering, manufacturing of computers	621.39
Financial and computer crimes	364.168
Information storage and retrieval	025.04
Word processing	652.5

CATALOGING AND CLASSIFICATION GUIDES

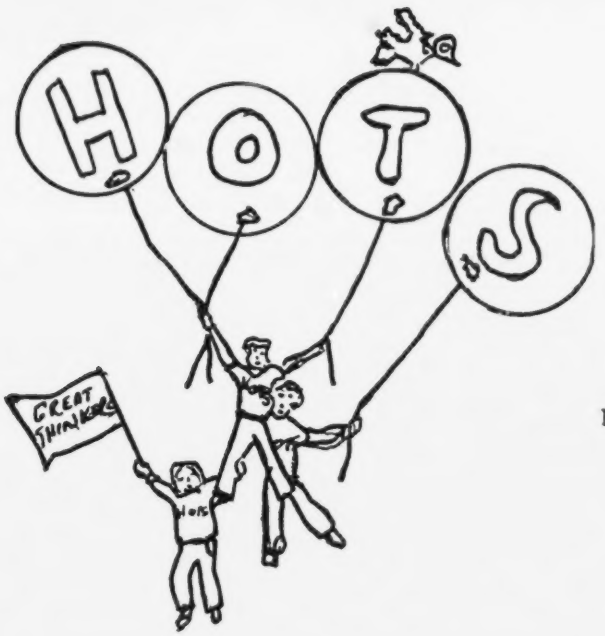
Beall, Julianne 004-006 Data Processing and Computer Science and Changes in Related Disciplines. Albany, N. Y. : Forest Press, 1985.

Comaromi, John P., ed. Manual on the Use of the Dewey Decimal Classification: Edition 19. Albany, N. Y. Forest Press, 1982.

Dodd, Sue A. Cataloging Microcomputer Files : a Manual of Interpretation for AACR2. Chicago, IL : ALA, 1985.

Guidelines for Using AACR2 Chapter 9 for Cataloging Microcomputer Software. Chicago, IL : ALA, 1984.

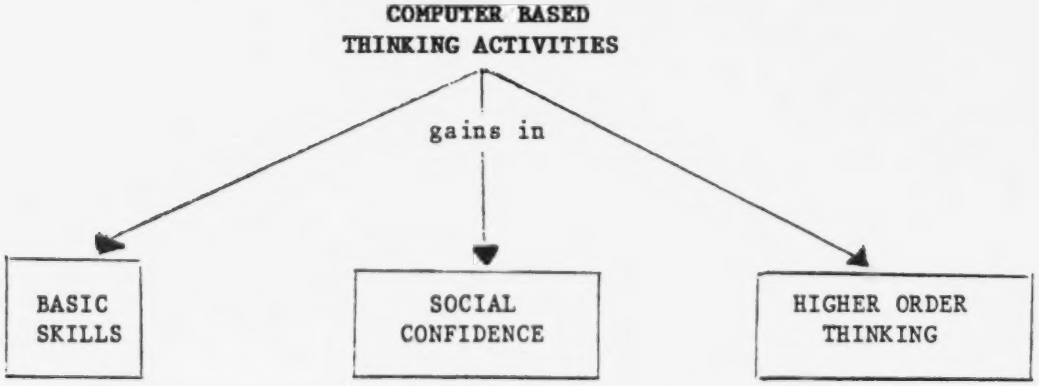
Maxwell, Margaret F. Handbook for AACR2. Chicago, IL : ALA, 1980.



DESCRIPTION OF THE HIGHER ORDER THINKING SKILLS (HOTS) PROGRAM

By: Dr. Stanley Pogrow, University of Arizona, Tucson, AZ

HOTS is a program that uses computers intensively and systematically to develop thinking skills in a way that also increases basic skills and social confidence.



HOTS is not a computer literacy program, but a program that uses computers to enhance the cognitive development of elementary level students to a greater degree than would otherwise occur. HOTS has been used initially as a higher order thinking approach to compensatory education. Its principles, however, can be applied to work with most students.

When used with Chapter I students in grades 4-6, the HOTS program replaces all the extra compensatory drill and practice with computer based higher order thinking activities. The thinking activities are designed to improve basic and social interaction skills, even as they improve thinking ability. The program can also be used with average and gifted students in earlier grade levels. HOTS can also be used in a less intensive way as a general computer

use program where the goal is not so much to improve learning, but to familiarize students with using computers and to reinforce content from the regular curriculum.

The HOTS program has grown in two years from a single site in Norwalk-La Mirada School District in California, to 21 schools around the country. Some additional districts where it is being implemented include:

Tucson Unified School District - AZ	Oceanside School District - CA
Charleston County - SC	Hopkins School District - MN
Detroit Public Schools - Michigan	Mary E. Dill District - AZ
Sunnyside School District - AZ	Shonto Navajo Reservation - AZ
Leavenworth Public Schools - Kansas	Cincinnati Public Schools - Ohio

Initial funding for developing and disseminating the HOTS program was provided by the Office of Technology in the Department of Education after being selected as the **most outstanding** technology project for the west coast and southwest.

WHY USE A HIGHER ORDER THINKING APPROACH?

1. The nature of work in society is becoming more sophisticated. Routine work is being automated. Simply having minimal competency in basic skills is no longer enough for the world of work the students will emerge into. The better jobs will go to those who are creative, entrepreneurial and who are used to developing and applying new ideas. Simply drilling students all the time will produce basic skills at the expense of learning to be comfortable thinking about ideas in unstructured situations. Research has shown that increasing basic skills does not by itself improve the ability of the student to generalize. Both types of teaching and learning must occur.

2. While most programs designed to improve learning focus on the teaching of content, or extra drilling in content deemed important, any learning that occurs is likely to be specific to that content. By teaching students general information processing techniques as the HOTS program does, students have a set of skills that can be applied to improving the learning of any content.

3. Our research indicates that Chapter I and the average student are capable of dealing with and solving complex problems, and that such activities can be designed to also improve basic skills and self-esteem. Such students are a lot brighter than we suspect, and are seldom challenged intellectually in the school to the extent of their ability to perform. Equity in the information age means developing the thinking ability of all students to their full potential in order to be able to compete in the information economy.

The HOTS program uses an information processing approach to higher order thinking. In such an approach to higher order thinking, students learn to work with information in a manner that resembles how long term memory of the brain organizes knowledge--namely as a set of sophisticated associations and linkages. Instead of viewing information as discrete elements, as often occurs when learning by rote, students learn how to develop associations among different types of symbols in order to solve problems.

Some of the specific information processing skills that students learn are:

- Developing confidence in expressing ideas publicly and in writing.
- Synthesizing large amounts of different types of information into a strategy, decision, or new idea.
- Inferring meaning from context clues.
- Developing and testing ideas to find best strategies to solve problems, including using feedback to determine when an initial approach is not working and developing and testing an alternative strategy.
- Planning the sequence of steps and operations needed to solve programs.
- Relating ideas to each other in non-obvious ways.
- De-contextualizing ideas and applying the same ideas in different environments when appropriate. Recognizing similar characteristics of ideas in different contexts.

In all activities students use language extensively to express ideas, and read extensively to interpret the reaction of the computer to their ideas. By providing problems that students are interested in solving, in a medium that motivates them, their use of language and ideas becomes deeper and enriched.

Students in the program also change behaviorally. They become: (a) more confident in their ideas and their ability to figure things out, (b) less impulsive in deciding which idea or possibility is correct and more willing to disconfirm their initial hunches and search for better answers, (c) more able to see relationships between concepts they formerly viewed as discrete, and (d) can consider more information at a single time in solving a task. These types of behaviors are the fundamental ones that are essential for being creative and successful in virtually any type of adult work role--be it as a nuclear scientist or a master craftsperson.

Is there any linkage between the HOTS curriculum and regular classroom activities?

While specific content is not taught in the HOTS program, the information processing activities on the computer are applied to content and concepts from the classroom where possible. There is no attempt in the HOTS program to link to most of the classroom curriculum, because the emphasis is on learning the process of making linkages rather than learning content. At the same time, when linkages are made they are a powerful way to reinforce the learning of classroom content and to stimulate students to apply that specific knowledge in more sophisticated ways. Classroom teachers are given the flexibility to decide which content is linked.

Linkage is by using vocabulary from the classroom in computer environments, and by reformulating large blocks of content information into questions and answers which are then applied to different computer programs.

The activities in the HOTS program are designed to increase the quality of the student's participation when content is presented in the regular classroom

curriculum.

The generalized nature of this linking process also means that the HOTS curriculum can be used with whatever existing curriculum and book series a school is presently using.

EVALUATION RESULTS

Evaluation data are only available at present for the program at the original site. Being the first site, many mistakes were made and many important lessons learned. At the same time, results were extremely positive.

The basic findings were that:

1. Students gained 17 percentile points and 12 NCE points over a two year period in reading as measured on the CAT standardized test. **This is double the national average gain produced by drill and practice programs.**

2. Math scores increased 11 percentile points and 7 NCE's over the same period--despite the fact that there was no formal math instruction in the HOTS program. **This suggests that improving the abilities to generalize, process information and solve problems does transfer to produce measurable gains in content areas.**

3. Students in the HOTS programs showed consistently greater gains in the higher order thinking measures used than a matched pair sample of compensatory students in two other schools.

4. Students in the experimental program had 40% more friends, among both Chapter and non-Chapter I students, than students at the control schools at the end of the first year.

5. Several students in the control schools that used computers for drill & practice reported that computers were good for helping **dumb** kids learn while HOTS students said that computers were good for helping kids learn.

These evaluation results indicate that: (a) higher order thinking activities can be used to produce substantial gains in basic skills, and (b) students develop high levels of self-confidence and esteem by becoming successful at intellectually challenging tasks. **The bottom line is that whenever we challenged the students, most exceeded our expectations.**

IMPLEMENTING THE PROGRAM

HOTS is the first computer-use program to develop a comprehensive, integrated curriculum that, along with special teaching techniques, takes maximum advantage of the potential of the computer to increase learning and the ability to think. Unlike programs of computer use where the actual work that students do is either non-specified or random, and it is assumed (hoped?) that generalizations will occur spontaneously, the computer activities in the HOTS program are spelled out in great detail and are developed and sequenced in accordance with fundamental cognitive theories of learning.

The HOTS curriculum operationalizes the ambitious goals of the program in a practical way. The curricular materials consist of a sequenced, detailed script for what the teacher says and does on a daily basis. Over 120 lessons are presently available, and another 100 will be developed over the next year. The curriculum is built around the use of the Apple IIe computer and the commercially available software listed in this brochure. **The curriculum is ungraded and can be used with compensatory students grades 4-6, and average to gifted students at lower grade levels.** The recommended hardware and software is available from local computer stores, while the curriculum can be purchased via the enclosed order form.

The keys to implementing the HOTS curriculum are:

1. Provide the equipment needed to implement the HOTS curriculum.

2. Train teachers to establish the learning environment appropriate to the more open ended, inductive and deductive reasoning activities on which the curriculum is based, and to substitute coaching approaches for direct instruction techniques.

3. Organize linkage activities every 2-3 weeks.

4. Improve the quality of teaching in the regular classroom using basic school effectiveness techniques such as increasing teaching time, direct instruction techniques and aligning the regular curriculum with standardized tests.

IMPLEMENTATION REQUIREMENTS

In order to implement **HOTS as a compensatory program** a school should do the following:

TIME ON TASK:
In order to produce measurable amounts of learning improvement, student use of computers must be far more substantial than that in computer literacy programs. It takes at least 30 minutes to teach lessons in the HOTS curriculum (some schools use 40 minute periods). Compensatory students are pulled out ofthe lab 4 times per week on an ongoing basis. This work substitutes for all other compensatory activities and eliminates multiple pullouts. This enables students to spend maximum time in their regular classroom.

Schools using the program as a general computer use program would cut back on the amount of time in the computer lab using only the time needed to teach those lessons they wish to cover.

COSTS TO EQUIP A LAB:
A list of recommended software and hardware are provided. There are two different sized labs. This first is a smaller lab, which can contain a maximum of 7-9 Apple IIe computers, which can serve up to 60-70 students and which is staffed by a single teacher. The larger lab can contain a maximum of 16 Apple IIe computers, can serve up to 110-120 students and is staffed by a teacher and aide. **In addition to the cost of the computers,** purchasing all the recommended software and additional equipment will cost an additional $7,000 for the smaller lab and approximately $12,000 for the larger lab. Most

of this cost occurs the first year. If a school already has some of the equipment and software, the costs are less. In addition, if a school chooses to use only part of the curriculum as general computer use activities, costs can be further reduced.

PERSONNEL:
One full time master teacher with about 8 computers can handle up to 60-70 students in the program. A teacher plus aide can handle up to approximately 120 students with 16 computers. Smaller numbers of students can be handled with part-time personnel.

The dedicated HOTS teacher should be someone with creativity and energy who is committed to improving learning and who believes in the ability of the students. It is more important that the teacher be familiar with the latest techniques of teaching reading and writing than being a computer whiz. The curriculum can also be taught by good classroom teachers.

TRAINING:
While the curricular materials are self-explanatory, experience has shown that most teachers need training to become comfortable with the more open-ended teaching and coaching techniques used in the program. A one week workshop is available to train teachers to use special teaching and coaching strategies involved in the program. The cost is $450 a day, plus expenses. Several schools and districts can participate in a given workshop and split the costs. If 4 lab teachers are involved, the daily cost falls to $112 each. Up to 10 can be accommodated in a single workshop. An ideal way to share this cost is to get a regional agency such as a county to sponsor the training. In addition, once a teacher or curriculum coordinator in a district has been trained, they can train other staff at no additional cost. Training is provided by Dr. Pogrow or a member of his staff either in Tucson or on-site at the district.

OTHER TRAINING AND SUPPORT SERVICES ($450/day plus expenses)

1. A two hour workshop for classroom teachers on how to participate in linkage activities. This focuses on how to teach students to write clues. This workshop is usually done by a district's own person. Materials for the workshop are provided free.

2. A one day workshop for the classroom teacher on how to use the HOTS curriculum as a general computer use program to develop literacy skills and reinforce classroom content. Eventually this workshop will be available on videotape.

3. Observation of the program and feedback on how to improve it. Two to three days are recommended the first year.

4. Summative evaluation techniques.

Since the HOTS program takes the place of a regular compensatory program, state compensatory and Chapter I funds can be used to purchase the needed equipment. Since HOTS teachers are able to work with more students than a regular compensatory program, **a HOTS program costs no more, and probably less, than the typical compensatory program.** Schools using the HOTS curriculum as a general computer use program would fund the activities out of their regular

computer acquisition and instruction budget.

Schools interested in considering the program can order the curriculum and/or contact Dr. Pogrow at:

Up to July 30, 1986: University of Southern California
School of Education
904 Waite Phillips Hall
Los Angeles, CA 90089-0031
(213) 743-2465

After July 30, 1986: University of Arizona
College of Education
Tucson, AZ 85721
(602) 621-1305

RECOMMENDED HARDWARE AND SOFTWARE FOR THE HOTS PROGRAM

The following is a list of equipment and programs that are used in the HOTS program. They are all commercially available.

This list is intended strictly to be a helpful guide to selecting materials for doing higher order thinking skills activities with students. Districts should not feel that they must purchase everything on the list in order to implement a higher order thinking skills program. In addition, there are many excellent drill and practice programs on the market which were not included, but which districts should consider if that is the focus of their computer use program. Finally, this list changes somewhat during the year. Schools interested in the program should contact Dr. Pogrow for the latest information before making any purchases.

— YEAR 1 GRADES 4-6 —

SOFTWARE	VENDOR	APP. COST	# OF COPIES	WHEN USED
Moptown Parade	Learning Tree	$40	1-2	Immed.
Banner Magic	Phoenix Software	$35	1-2	Immed.
Crossword Magic**	Gessler Pub NY or L&S	$40	1-2	Immed.
Bumble Games	Learning Company	$40	1-2	Immed.
Lawrence Hall	Creative Play	$65 first $5 for others	1-2	Immed.
Apples	MECC	Free	1-2	
Kidwriter	Spinnaker	$30	1 per 3-4 computers	Immed.
Microzine #2	Scholastic	$50	2	Immed.

* The first number is the amount for small labs, & the second for larger labs.

** Make sure you get the latest version which allows serial printer.

MEDIUM PRIORITY (BY CHRISTMAS)

Bumble Plot	Learning Company	$40	1-2
Print Shop	Broderbund	$50	2-3
Logo	Apple	$50	1-2
Bicycle	MECC	Free	1-2
Lemonade	MECC	Free	1-2
Oregon Trail	MECC	Free	1-2
Bank Street Writer (128K version)	Broderbund	$80	1-2
Bank Street Speller	Broderbund	$65	3-5
Koala Pad	Koala	$100	1-2
Golf Classic	Milliken	$60	1-2
Gertrude's Secrets	Learning Company	$50	1-2
Game Show	Computer Advanced	$40	3
Tic Tac Show	Computer Advanced	$40	3
Wordmaster	DLM	$45	1-2
Master Diagnostic	Nikrom (or any other disk drive diagnostic program that can be used to measure the accuracy of the disk drives)	$70	1

LONGER TERM (BY MARCH)

Fraction Factory	Counterpoint	$25	???
Fractions	Sterling Swift	$50	1-2
Gertrude's Puzzles	Learning Company	$50	1-2
Moptown Hotel	Learning Company	$50	1-2
Factory	Sunburst	$45	1-2
Idea Invasion*	DLM	$45	1-2
Graphing Program	Not yet selected, probably Graphmaster by Grolier.		

* This is the DLM program where you can construct your own homonym and synonyms puzzle--MECC has an equivalent program.

HARDWARE AND EQUIPMENT

Apple IIe's, each equipped with: color monitor, 128K memory, Mouse
Superserial card.

Enough computers need to be purchased so that there are enough to support a pullout program with ideally only one pullout per class, or at most two.

Priority need immediately

One Imagewriter II printer **per 4-5 computers** @ $450
One INMAC printer switch and 6 extension cables (Shielded male to male 25 pin in varying lengths from 6-25') **per printer** $300
One Printit card with serial connector **per printer** for screen dumps @ $230

Surge suppresser		**
1 extra disk drive per 2-3 computers for replacements, duplication of data disks, and for using speller checker and other software which needs dual disks	@	$250
Cannon color printer (optional)		$600

Longer term need (after February)

One TOPO talking robot (Model 3)	$2000
One Apple graphics tablet (optional)	$ 700
Two Hayes joysticks	$ 50
Two Koala pads with external port (optional)	$ 240

* I am presently looking into using a trac ball instead of a mouse.
** Variable depending on whether one is attached to each computer ($50) or a master protector is used. There should also be master switches for the equipment.

SUPPLIES

7 Boxes continuous tractor feed paper	@	$ 20
7 Boxes of disks	@	$ 25
30 Printer Cartridges or possible re-ink existing		$ 120
10-15 Color cartridges		??
3-40 disk trays	@	$ 35
1 Wet/dry vacuum cleaner		$ 40
Non-chalk blackboard		??
3 Disk drive cleaner disks		$ 27
Lab notebook for each student		

SECURITY

Good alarm system.
Try to avoid tie down systems that make it impossible to take off the cover and change boards.
Do not allow janitor or cleaning person in the room to clean up. Use vacuum cleaner and student volunteers to clean up your own room. Have unique master key.
Do not use door locks that have pins in the hinges.

MAINTENANCE

Check disk drive speed with diagnostic program once a month.
Clean disk drive once every three months.
Establish a pool of $100 per machine the first year, add as needed in subsequent years.

ADDITIONAL SOFTWARE FOR YEAR 2 OF THE PROGRAM

Discover	Sunburst	$40

File program, possibly Bank Street file.

COMPUTER SOFTWARE FOR CRITICAL THINKING

By: Helen J. Schwartz, Oakland University, Rochester, MI

For those used to using educational software for drill and practice or for simulations, the notion of software for critical thinking may seem self-contradictory. After all, critical thinking involves a process of understanding data, analysis and criticism. How could such a complex process be modeled without making it reductively simple? How could all defensible responses be pre-determined, especially if the critical process is essentially creative and non-predictable?

The two programs discussed here--SEEN and ORGANIZE--change the notion of what computer programs should do in support of critical thinking, one of the higher cognitive skills in education. If the process is complex, don't try to model it inflexibly. If the answers are diverse and creative, don't ask the computer to check their validity. Instead of a rigid model, provide the learner with the freedom to explore what he needs. Instead of predetermined answers, encourage people to serve as models and responders and support the learner's growing in her ability to criticize herself and edit her work.

Both programs build on the notion that simply asking good questions may be valuable to a learner in critical thinking, a pioneering notion described in Hugh L. Burns and George H. Culp, "Stimulating Invention in English Composition through Computer-Assisted Instruction, " Educational Technology, 20 (Aug. 1980), 5-10. ORGANIZE (forthcoming from Wadsworth Publishing Company) is a pre-writing program with tutorials on audience analysis, development of ideas, argumentation and approaches to introductions. SEEN (available for Apple II computers from the author) is a program to help students learn actively: seeing more in what they observe and read, forming hypotheses based on their personal response, and then sharing those ideas with other students for comment and review.

SEEN has three parts: 1) A tutorial with open-ended questions is tailored to a task central in a discipline. Here students encounter questions incorporating their choice of topic and providing thought-provoking prompts to generate ideas and evidence in support of their thesis. 2) A programmed-in bulletin board allows students to refine and expand their ideas by comparing their work to others' and critiquing in a non-threatening environment. 3) Storage capacity so that teachers get a record of learners' activities at a session and students get a printout of their work or a text file that can be loaded in a compatible word-processing program for editing or expansion. The original program (now available) helps students analyze a character in literature, but a shell program (under development) will allow a teacher to load other tutorials (for example, reviewing historical cause and effect, or analyzing stylistic characteristics of an art work) or create their own.

Let's see how a typical session might go. A student in a world literature class responds to the preliminary questions to establish a thesis (with the student's choices listed in capital letters): WIFE OF BATH in CANTERBURY TALES is DOMINEERING. The tutorial then asks Kami (the student's pen-name) to provide various kinds of evidence to support her hypothesis. (Kami's answers to the computer's questions are underlined.)

What does WIFE OF BATH do that shows WIFE OF BATH is DOMINEERING?
She hits her 5th husband when he tries to push her around.
She makes sure she's the first person to go to the altar on Sundays.

Kami can enter as much evidence as she wants (or skip the question if it does not apply). Then, in a similar manner, the program asks for further evidence that the Wife of Bath is domineering--because of 1) what she says, 2) how others react to her, 3) how her behavior compares to others in a similar situation, and 4) what the third-person narrator (if any) says about her. As Kami proceeds, she gets numerous chances to modify and edit her ideas. The program does not judge spelling or ideas, but it does, at this point, encourage self-criticism by asking her to look at her evidence critically. Kami is asked to think of any exceptions to her thesis or contradictory examples:

What evidence shows that WIFE OF BATH is not DOMINEERING?

She signs over her land to her fifth husband.

The program then gives Kami the choice of leaving the exception without comment or explaining the apparent contradiction. When she chooses the latter, Kami's evidence is re-listed on the screen, followed by the word "but" and she can then explain. This question shows students that an argument is stronger by acknowledging exceptions than by ignoring them. Furthermore, many times the mere act of stating an exception gets the learner to see that the contradiction can be explained.

The final two questions help Kami to review her evidence and develop them more coherently. Kami is asked whether the character changes and, if so, how. Then she is asked to summarize her reaction to the character. Here, instead of having a limited space (to encourage a large, supportable thesis), she gets as much room as she needs to develop the insights she has discovered in considering her evidence.

The tutorial alone helps students review evidence from their reading systematically. In this sense it is an aid to writing. But after several uses, the student also sees that the questions apply to much of their reading. Because they see the kinds of evidence that are useful in supporting a thesis, they begin to read differently, noticing more evidence than before.

After Kami has completed a tutorial, she is eligible for access to the work of her fellow students. There she might see, for example, that one student considers the Wife of Bath to be "sad"; another sees her as "obnoxious", a thesis similar to Kami's, but (as it turns out) using different evidence. When students see that others have reached different conclusions from the same reading, they understand better why they have to provide evidence in support of their opinions. And sometimes, reading the notices of other students will cause them to change their opinions. (For a full report of a field test with a preliminary version of SEEN, see Helen J. Schwartz, "SEEN: A Tutorial and User Network for Hypothesis Testing," in The Computer in Composition Instruction: A Writer's Tool, ed. William Wresh [Urbana, IL: NCTE, 1984].)

ORGANIZE provides a systematic, but flexible approach to writing with questions adapted to the students' chosen topic. This program helps students to:

--develop ideas
--anticipate and meet audience needs
--argue an issue (to debate or persuade)
--order and evaluate ideas efficiently
--overcome writer's block

Students can concentrate on their ideas without worrying about the mechanics of writing because they realize that the program helps them cover all important aspects of the writing assignment while storing their ideas for later review and use. They can play with ideas because they are in control--of what tutorials they do, whether they save or scrap their work, whether they transfer it to a compatible word-processor for expansion or editing. Gradually, they can absorb the approach presented, effortlessly and in a way adapted to their own writing style and work habits.

Again, let's look at a sample session. Tom chooses to work on a new project, so the program prompts him to survey his writing goals by defining Basic Terms: topic, thesis, audience and purpose. Then he can choose among four segments:

DEVELOPMENT to generate ideas
AUDIENCE to assess audience needs and attitudes
ARGUMENT to list, test & order your argument for debate or persuasion
APPROACHES to get an introduction or outline or just to start writing

Within most segments, he will find several tutorials to choose from (as shown in the Map of ORGANIZE).

He proceeds at his own pace with full control of his ideas and options. Within a tutorial, he can see additional explanation of any question, can review his answers so far, can "undo" an answer (by backing up one or more questions), can always return to the Main Menu, get reminders about directions or end his session.

At this session, Tom chooses to write about FLEXTIME (his topic), saying IT'S A SENSIBLE IDEA is his thesis, writing to GENERAL as his audience, with the purpose to ARGUE THAT FLEXTIME BE USED. He's already done some research on his topic, but he wants to try out several ways of organizing his ideas. He goes to the section on DEVELOPMENT and chooses from the tutorials there: definition, analysis, description, narration, process, cause and effect, or the one that Tom chooses at this session: comparison and contrast.

Here he is asked to construct a matrix (what things will be compared vs. categories of comparison). First, he designates FLEXTIME and NORMAL as the examples of work schedule he will discuss. Then the program asks how this comparison will help achieve the purpose. The response--"points up the advantages"--guides him in answering the next question about categories for comparing and contrasting FLEXTIME and NORMAL. Tom answers: benefits to worker and benefits to employer.

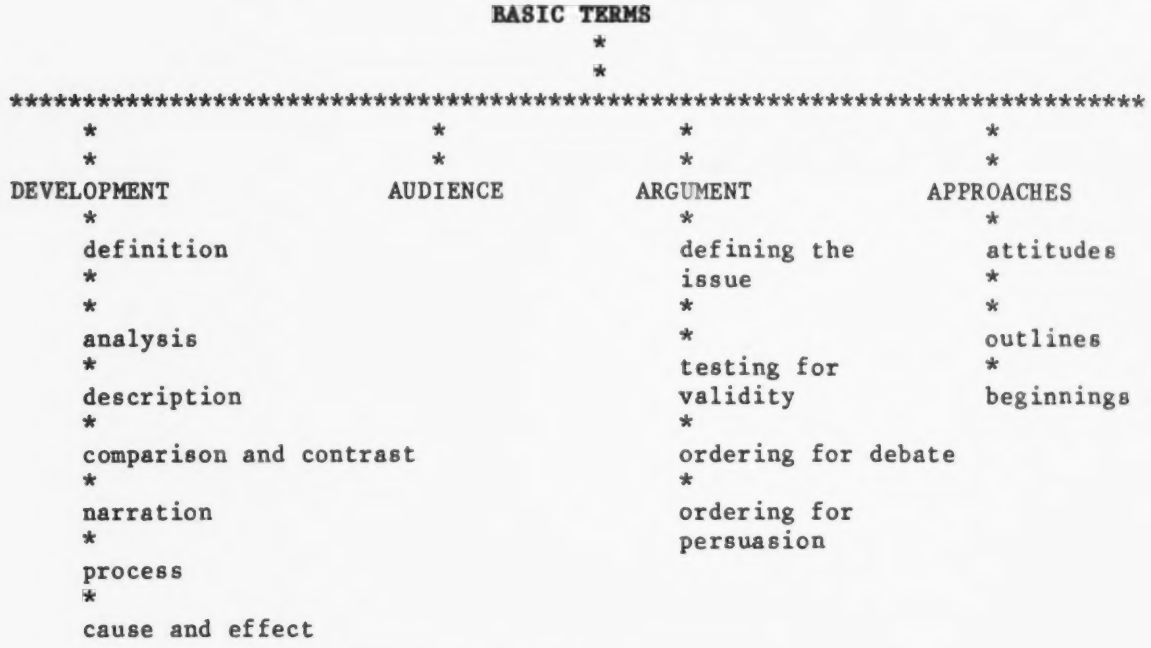


Figure 1: Map of ORGANIZE

After checking his matrix (kinds of work schedule vs. kinds of benefits), he is asked next to fill in evidence:

> Describe FLEXTIME in regard to BENEFITS TO WORKER.
> individualizes work schedule
> makes adjustments possible for working parents
> can extend vacation time by a day or two

And so on for flextime with regard to employers' benefits and for normal schedules with regard to benefits to workers and benefits to employers.

Tom could have used the program before he started his research, too, as a way of limiting his topic and seeing what kinds of evidence would be useful to him. Or he might use the program again later still if he gets writer's block. In the APPROACHES section, he could try an overall outline for a standard introduction or try for a fresh approach in the Attitudes tutorial. In light of his purpose, if he ever decided to present his ideas for debate or persuasion.

What do ORGANIZE and SEEN have in common? Neither presents canned answers. Both provide a structure within which the learner can try out an approach. If it is useful, repeated use inculcates that approach in the learner so that the tutorial can be left behind. SEEN allows people to check out their ideas with their ultimate audience--people, not a computer. ORGANIZE lets people try out different approaches at different stages of their writing. Both programs store ideas so that learners can trace their progress in thinking, and both allow learners to transfer what they have created to word-processing programs for expansion or editing. Neither program induces dependency.

SEEN is available for Apple II computers with 1-2 disk drives; printer and compatible word processor (such as Applewriter) optional; from Helen Schwartz, Box 911, Rochester, MI 48063.

ORGANIZE will be available for Apple IIe or IIc with 128K and 2 disk drives; to be published by Wadsworth Publishing Company, 10 Davis Drive, Belmont, CA, 94002.

PRODUCING A SCHOOL NEWSPAPER WITH MICROCOMPUTERS

By: Chris Steel, Wilmette School District #39, Wilmette, IL

Newspaper accounts and research in microcomputers in education report that students are becoming less enchanted with using computers, microcomputers are not being used to their best advantage, and microcomputer education is isolated from other disciplines.

If students are to use the microcomputer as a tool, then the tool must be combined with everyday experiences and the product of using microcomputers must be obviously relevant to a student's life. Just because we adults say that the microcomputer is a tool does not make it so; junior high school students must experience the relevancy.

In an attempt to make the microcomputer elective a part of a student's everyday life, two teachers at Wilmette Junior High School, planned a course incorporating writing skills and microcomputer use with the end product being the students' contribution to their community.

In the elective, The Newspaper, students learn the principles of producing The WJHS TIMES, a quarterly, with Springboard's Newsroom microcomputer software. The course combines practice and application of writing skills; instruction in and management of using a microcomputer with integrated software; and development and experience in social and work skills. Students must apply for newspaper jobs, contribute a story to the school newspaper, collate and distribute the final issue, and create a personal front page.

In the first few weeks, students receive instruction and practice in newspaper writing styles and story structure. Each student must write a news story, feature story and an editorial. Through discussion and examples, students learn the style and form for reviews and sports stories. Filmstrips and worksheets give students information and practice about differences and similarities in story structure, and the elements needed in each of these stories. The importance of a good lead sentence or paragraph is stressed. In other exercises, students practice concise writing, proofreading skills, and good headline construction. All assignments are kept in a student stenographic tablet. To get information students must learn to ask the right questions and students practice that art in interviews with each other. Early in the quarter, students determine the layout of the entire paper as well as of individual pages by critiquing a previous issue or other school newspapers.

On the first day students apply for a job on the newspaper staff by completing an application form that asks for their school and activities interests. Positions include managing editor; editorial, news, sports, or review editor; copy desk; and reporter. Weekly staff meetings are held so editors may meet with their respective boards to give assignments and plan the content and layout of their pages. Editors are responsible for assignment beats and getting reporters to meet deadlines. The managing editor is responsible for making final decisions about content and layout and getting editors to complete their pages.

Students learn to use the software and move around THE NEWSROOM as if they were working in a newspaper office. In each room students control the microcomputer's activities by selecting from a menu of icons. Assignments are

designed to give students instruction and practice in entering and editing copy, selecting different fonts for headlines and stories, and adding photos. With notes in their stenos, students compose stories for the school newspaper at the microcomputerized Copy Desk, the word processor of the software. In the photo lab students select from pre-drawn graphics to add to their stories or create cartoons. Here they learn to crop a photo and snap a picture. They may magnify, add to, or change details of the given photos caption. Although only the editors are involved in layout for the school newspaper, all students use the layout area to design their own front page. In the press room students must run the presses, learn to configure the software for the printer, and print their own front page. The software does have the ability to handle a modem. At this time we do not have modems; however, the possibility of having students go on-line and communicate with students in other districts is intriguing.

The end product is not an isolated project that students complete to earn a grade. Students become a part of a working staff and must deal with each other in a very real way. Each student contributes to a group effort that is then sent out to be read by their friends, teachers, and administrators. As reporters they go out into their community for information and bring other students into their world of computer classroom by interviewing or encouraging students to send letters to the editor. Students must address the problem of appearances, correct or incorrect facts, and the impact of their words on their friends and teachers. They learn to make decisions about relevancy of information and to deal with the ethics of the information they use. The experience of writing, using a computer, and producing a newspaper integrates the students' academic and social worlds, thus encouraging the use of the microcomputer as a tool.

A PLAN FOR THE UTILIZATION OF DEMOGRAPHIC DATA

By: John Tofano, Community Consolidated School District 59, Arlington Heights, IL

This paper describes the process that was utilized in Community Consolidated School District 59 in developing a computerized system that would assist district administrators in the task of analyzing and projecting enrollment trends within the school district's boundaries. The school district employed Dr. Edwin Thomas, Director of the Chicago Area Geographic Information Study (CAGIS), as a consultant to provide assistance on this project. With the assistance of Dr. Thomas, the district developed a system that utilized census tract and block codes to create a geographical code number that could be added to each student's data record that was maintained on the central computer system. Census block and tract codes are the important items that are needed to create a base file that identifies important geographic areas that exist within the boundaries of Community Consolidated School District 59.

The creation of base files containing specific geographic data, such as, the district's attendance boundaries, census tract/block numbers, street names and address ranges, is the important first step in developing geographical code numbers that can be maintained as part of a student record. This base file is often referred to as the District's "Dime" file. In order to better understand the concept of a Dime (base) file and the process of geocoding, the following background information is provided.

Geocoding and Dime (Base) Files

The GBF/Dime System includes geographic reference files known as GBF/Dime Files, the census Bureau's Metropolitan Maps, a series of clerical procedures and computer programs for maintaining the files and computer software for using the files. GBF/Dime stands for "Geographically Based Computer Files" (GBF) and are created through a process known as "Dual Independent Map Encoding (Dime), a means of coding geographic information so that it can be easily edited by computer.

The creation of a Dime file begins with the Census Bureau's Metropolitan Map Series, a group of maps that shows the boundaries of all the political and statistical units in metropolitan areas. Address range information is also required. Information about these boundaries, areas and address ranges must be clearly coded and entered into the computer.

Each street included in a file is divided into one or more segments, the basic components in the file. Each street segment, usually a length of street between two intersections, is represented by a record in a Dime File. Each record contains identifiers for the end points (nodes) of the segment, the related low and high address numbers, and appropriate codes for the blocks, census tracts or other geographic sections associated with the segment.

The initial GBF/Dime Files were created in the early 1970's by the Census Bureau in cooperation with local agencies. Later, the Census Bureau worked closely with these agencies, usually regional planning groups or councils of governments, to ensure that each local file was correct and that subsequent changes to the street network and streets added by new housing subdivisions were included in the file. As new metropolitan areas were designated, new files were also created.

A GBF/Dime File is available for the Chicago Standard Metropolitan Statistical Areas (SMSA) which includes Chicago and the Suburban area. The Chicago (SMSA) includes Cook, DuPage, Kane, Lake and McHenry counties. This File contains all the statistical boundaries recognized for the 1980 census. The streets, street names, and boundaries contained on the file were submitted to the Census Bureau by local agencies between 1976 and 1978.

Applications for the GBF/Dime System

The GBF/Dime File was used as the principle resource by the Census Bureau for completing the 1980 census. However, GBF/Dime Files are also an important resource for local agencies and organizations at the city, county or regional levels. These agencies may utilize the GBF/Dime Files and appropriate computer software to relate data from any number of local administrative or survey files that contain street addresses and geographic areas in order to tabulate, display and analyze this data.

The relating of data to geographic areas, or geocoding, is the process of adding a geographic code, such as a block or census tract number, to records with addresses. Geocoded records can be tabulated and statistical tables produced for analysis. In Community Consolidated School District 59, the process of geocoding student records was started in 1982. Every year since 1982, the school district has regularly matched its enrollment file to the Dime File comprising the school district's attendance boundaries in order to append census tract and block codes to each pupil record. Once these tract codes were appended to each student record, these records could easily be sorted and information such as the number of students living in those blocks that reside outside the 1 1/2 mile limit from school can be tabulated.

Geocoding Applications in Community Consolidated School District 59

In District 59, the base file contains information for approximately 552 blocks located within the district. Each student record contains a 9 digit geographical code that defines the specific block where the student's home is located. In addition, the base file has been enhanced by adding to the file, locational codes for the elementary and junior high schools located within the district. Information in the file has been carefully checked for each student to ensure that the allocation of student addresses or births is correct. Thereby, maps and tables produced from the geocoded data will capture conditions in the district as accurate as is possible.

Demographic information on all students is maintained on the district's central computer system. Since a geographical code is part of each student's record, it is possible to utilize the computer system to search and sort these records by almost any selection criteria in order to produce geographical data requested by department administrators. The following are examples of applications for which reports using these geographical codes have been utilized.

1. Birth data by attendance.
2. Attendance boundary changes - number of students affected.
3. Data provided to Township High School District 214 prior to closing Forest View High School.
4. Report indicating number of students residing in multi-housing units.

At the present time, the school district has utilized the geographical data available for reporting purposes in a very limited way. As we continue to work with data, additional applications for assisting the district in the planning and assessing the district enrollment patterns will continue to evolve and develop.

ROBOTS FOR THE CLASSROOM

By: Sandra Turner, National College of Education, Evanston, IL
Julie Poage, Roycemore School, Evanston, IL

Classroom robots provide an opportunity for students to explore the fascinating world of robotics while they are learning a variety of problem-solving skills. Used as an introduction to Logo, robots give students concrete experiences in moving and turning an object and serve as a bridge to manipulating the representational turtle on the Logo screen. Robots that speak, avoid obstacles, and sense motion, light, and sound also help students understand the difference between human intelligence and machine intelligence. We will compare four different robots that we have used in our own classrooms and describe activities in which the students use the robots to solve specific problems.

COMPUROBOT

Compurobot is a small, battery-powered robot which can be programmed to move forward or back, turn right or left, sound a bell, and flash a light. Commands are entered from a keypad located on the top of the robot. Up to 48 commands can be stored in memory and executed as one sequence.

Compurobot is simple and easy to use. Some teachers of primary students have complained that the buttons on the keypad are too small and too close together for their children's small fingers, but others say the small buttons are not a serious problem. Even though the robot is noisy and its movements are not very accurate, we think it is a bargain at $39.95.

We have used Compurobot to give young students practice in making estimations and as an introduction to Logo. In one activity, students sit in a circle on the floor and are instructed to send Compurobot from one person to another across the circle. Each student adds commands to the existing sequence of commands so that in the end the robot follows a path to make the shape of a star or polygon.

Compurobot's movements are based on a unit of time rather than a unit of distance. For example, RIGHT 2 means to turn right for two seconds. Although the Compurobot commands do not transfer directly to Logo, the more general skills in estimation, left-right orientation, and sequential thinking do provide a concrete basis for students' later work with Logo.

VALIANT TURTLE

The Valiant Turtle can be programmed in Logo with an Apple, Commodore, or IBM-PC computer. The robot is shaped like a turtle so that it is easy to see its heading. It has a pen that can be raised or lowered with the appropriate Logo commands. An infrared transmitter sends signals to the turtle so the turtle is free to move within a range of six meters without any cables. The transmitter is connected to an Apple computer through either an Apple Super Serial Card or a Grappler+ parallel card. (You specify which interface you have when you order the Valiant.) Rechargeable batteries and a recharger are included.

With an Apple computer, either Apple Logo (LCSI) or Terrapin Logo (MIT) may be used to program the Valiant Turtle. In Terrapin Logo, commands to the floor turtle must be preceded by the letter T, as in TFD and TRT, to distinguish

them from commands to the screen turtle. In Apple Logo. however, the original primitives are redefined to control both the floor and screen turtles.

The Valiant is slow but reasonably accurate on a hard surface. One turtle step is represented by one centimeter. In a procedure to draw a polygon or a star shape, the pen will end up very close to where it started. A small screwdriver and instructions for adjusting the accuracy are included.

A robotic turtle, such as the Valiant. provides students with a concrete Logo object that can be very useful in debugging their programs or in understanding new Logo ideas. Since the robot moves and turns very slowly, it can be used to trace a "buggy" procedure or to explain the embedded recursion of a fractal curve. One limitation is that the robot only understands relative movement (FD, BK, RT, LT) and not absolute movement (SETPOS, SETHEADING).

For practice in estimating angles and distance, we have drawn mazes on the floor with masking tape and have the students take turns giving the turtle commands to negotiate the maze. Nonrectangular mazes are even challenging for older children. Turtle tennis or ping pong is another fun problem solving activity. Use masking tape to lay out a small tennis or ping pong court on the floor. Two teams of students take turns giving exact commands to the turtle so that it will end up in the proper region on the opposite court. Keep score as in tennis or ping pong. Students learn to watch carefully so that they can learn from the other team's mistakes.

Although the Valiant Turtle does not have the speech capabilities and touch-sensitive features of the original Tasman Turtle (which is no longer available), it is affordable ($399.95), cordless, and reasonably accurate.

HERO JR.

The Hero Jr. is a programmable robot with both speech and movement capabilities. It can be controlled using a built-in keyboard, a hand-held remote control transmitter, or a BASIC program that is entered from a computer using an RS-232 interface and then stored in the robot's memory.

Hero Jr. has several preprogrammed speech routines that include songs. poems, and games. The robot can sense light, sound, motion, and obstacles which may be in its path, and can be programmed to maneuver around a room.

The built-in functions available with Hero Jr. are simple to master, but are very limited. In order to program your own routines, you must enter BASIC programs via a "dumb terminal" and an RS-232 interface (e.g. Apple Super Serial card). Hero Jr. understands its own version of BASIC. which is available on a plug-in cartridge, allowing both movement and speech to be incorporated into BASIC programs. Speech is programmed using phonemes, and the resulting sounds are somewhat difficult to understand.

Hero Jr. is intended more for the hobbyist than for classroom use. It provides an interesting demonstration of the capabilities of robots. Although it is easy to use with the built-in functions, it is difficult to program. Hero I, a more complex version of the Hero Jr., provides a wider variety of built-in and programmable functions, including an optional arm with a gripper. At $999.95 (assembled) Hero Jr. is a relatively low cost robot when compared to Hero I ($1699.95) or the newer Hero 2000 ($4000).

TOPO

Topo is a fully programmable robot intended specifically for classroom use. It stands three feet tall, moves on three wheels, and has synthesized speech. It is controlled through an infrared communication device which is attached to the computer by an Apple Super Serial card. Topo can be programmed using with Forth or Apple Logo II. Because Forth is a language unknown to most students (and teachers), Apple Logo II is the preferred language.

Both the speech and movement capabilities of Topo are excellent. Speech can be reproduced in a variety of pitches and volumes with relative ease, and require few phonetic changes in order to be understood. Topo also moves and turns very accurately.

Topo provides a concrete device for students to use with Logo. Young children often find it easier to transfer the movements of the Logo turtle to Topo rather than to the turtle on the screen. Topo also provides an opportunity for students to use the list processing capabilities of Logo in conjunction with the speech functions of Topo.

Several Logo projects have been designed for use with Topo. "Topo Says", which is similar to "Simon Says", introduces kindergarten students to robotics. "Topo Tennis" encourages students to estimate distance and angles in order to send Topo across an imaginary court. Topo can also be programmed to recite data about the Periodic Table of Elements, thus introducing the concept of databases using Logo.

Topo is sold by Androbot, Inc. for $1795, which includes the Forth programming language. The Topo Logo Extension ($99) is required to use Topo with Apple Logo II and is also available form Androbot. (Apple Logo II must be purchased separately.) An Apple Super Serial card and 128K memory are required in order to use Topo with the Logo Extension. Androbot also sells a scaled-down version of Topo, called F.R.E.D., which is programmable in Apple Logo (64K) or Forth, has limited speech capability (57 words), and includes a pen for drawing. F.R.E.D. costs $499, plus $79 for the Logo Extension.

COMPUROBOT
Education Plus
18584 Carlwyn Drive
Castro Valley, CA 94546
(415) 582-8252

VALIANT TURTLE
Harvard Associates
260 Beacon Street
Somerville, MA 02143
(617) 492-0660

HERO JR.
HERO 1
Heathkit
Heath Company
Benton Harbor, MI 49022

TOPO
F.R.E.D.
Androbot, Inc.
101 E. Duggett Drive
San Jose, CA 95134

BIBLIOGRAPHY

Barker, Ronald G. (1984, May/June). Types, utilization and application of robots for industrial arts education. Industrial Education, p. 12.

Barnett, Harvey. (1984, May). TOPO--A tutor and tool for your classroom. Call-A.P.P.L.E., p. 61.

Barnett. Harvey & Better, Jennifer. (1984, Spring). The language of robots. Computers in Reading and Language Arts, p. 35.

Bull, Glen, & Cochran, Paula. (1985, May). Tail of a turtle: A Valiant effort. The National Logo Exchange, pp. 2-3.

Howe, Samuel F. (1984, January). It's 1984 and robots are in the classroom. Media & Methods, pp. 9-10.

Keller, Joan & Shanahan, Dolores. (1983, May). Robots in the kindergarten. The Computing Teacher, pp. 66-67.

Kimbler, D.L. (1984, Fall). Robots and special education: The robot as extension of self. Peabody Journal of Education, pp. 67-76.

Marsh. George, & Spain, Tom. (1984, March). Robots in the classroom. Electronic Learning, pp. 48-53.

Owens, Peter. (1983, December). At home with....the Hero 1. Popular Computing, pp. 166-174.

Shryock, Betty. (1984, August). Reading, writing, and robots. Instructor, pp. 30-34.

Slesnick, Twila. (1984, March). Robots and kids: Classroom encounters. Classroom Computer Learning, pp. 54-59.

The Valiant Turtle. (1984, July/August). Practical Robotics, p. 32.

Treehouse: Robots! (1981, September). Classroom Computer News, pp. 104-110.

Watt, Molly. (1984, Mid-October). "The robots are coming!" Popular Computing, pp. 71-77.

ARTIFICIAL INTELLIGENCE IN EDUCATION

By: Brad Waggoner, MICRO-IDEAS, Glenview, IL

Educational software, in order to be more than a conditioning process for the student, must be able to emulate human thought. This emulation of intelligence will not be exactly like human intelligence. Seymour Papert observed that artificial intelligence should be to human intelligence as an airplane's flight is to a bird's flight. Artificial intelligence deals with types of problem solving and decision making processes that human beings use to adjust to the world. These processes, which humans take for granted as being "simple", are in reality extremely difficult, if not impossible, for the computer. Some of these cognitive strategies that students and teachers employ are now becoming available on a limited basis for microcomputers. The day will be coming when the student will be able to ask a computer for information in his own words, even misspelled, and not be faced with an error message or no response. Better yet, software may be able to diagnose a child's defective learning strategies and change its presentation to compensate. This may seem like a dream, and realistically will take years to come about, but teachers need to provide direction for software implementation of present and future artificial intelligence techniques.

N. J. Nilsson describes four principal application areas for artificial intelligence at the present time. These areas include natural language processing, computer vision, expert systems, and problem solving and planning. A very important adjunct is the development of robotics and animation, the mechanical manifestations of these processes. Natural language processing allows a person to communicate with a computer using his own syntax, semantics and morphology. This is now accomplished by setting up dictionaries of synonyms and applying parsing algorithms developed through syntactic analysis. The processing involved in this type of analysis employs a large amount of memory and some significant processing time delays.

Some of the products available are INTELLECT by Artificial Intelligence Corporation, PEARL by Cognitive Systems, SAVVY by Excaliber Technologies, and CLOUT by Microrim. These products range in price from $250,000 to less than $200.00.

An example of the educational use of a natural language interface is the program presented by the author. The program was a data base of bird species developed for use by upper elementary students. It was implemented with CLOUT and LOTUS 123. CLOUT acts as a natural language front end so that the child is free to use his own language to seek interesting facts and new relationships. The intent was to create a more natural environment for discovery learning.

Robots, as well as people, seek information from their environment by the use of vision. Pattern recognition is an extremely complicated process. It is very costly in processing time and memory to do the simple task of distinguishing between different objects mixed up in a container. Implementation of these techniques on microcomputers is prohibited because of the immense amount of mathematical operations found in even the simplest Fournier transformations.

Expert systems and problem solving and planning techniques potentially hold the most promise in education. Expert systems are a collection of heuristics, or rules of thumb by which a knowledge base can be evaluated in order to draw conclusions. In most cases a person called a knowledge engineer will enter the facts and assumptions that an expert would use in solving a problem. Some of the products available for microcomputers are: EXPERT/EASE; ES/P ADVISOR; TOPS1; and ADVICE LANGUAGE/X. An educational application which we will see in the near future is a program being developed at Utah State University to determine eligibility for learning disabled students. This program, that uses an expert system called M1, uses the methods of evaluation followed by an expert in the field of learning disabilities. They feel this diagnostic aid will: 1) speed up team referral processes, 2) eliminate referral biases caused by dominant team members, and 3) facilitate compliance with mandated percentages for identified populations.

More directly related to instructional application is the project now being designed by the author using an expert system called INSIGHT 2 PLUS by Level Five Research. This project involves producing an adjunct program for his natural language data base that will classify birds and will also instruct the child on the processes involved in classification. This last project, when interfaced with a videodisc, could provide a rich environment for independent learning.

We as educators should help guide software developers as they seek new educational applications. The technology is extremely limited at the present time and will find little or no implementation on our present eight bit microcomputer base. As more powerful microcomputer hardware enters the educational community and prices decline, we will see more and more of these techniques applied, not only in our classrooms, but in our everyday lives.

REFERENCES

Nilsson, N. J., "Principles of Artificial Intelligence", Palo Alto, CA: Tioga, 1980.

Gevarter, W. B., "Intelligent Machines: An Introductory Perspective of Artificial Intelligence and Robotics", Englewood Cliffs, NJ: Prentice-Hall, 1985.

Harmon, P., "Expert Systems", New York, NY: Wiley Press.

Papert, Seymour, "Mindstorms", Basic Books, Inc., 1980.

Ferrara, J., Parry, J., Lubke, M., "Technical Paper Class 2: An Expert System for Student Classification", Utah State University, Logan, Utah: May, 1985.

DIRECT SATELLITE TELEVISION PROGRAMMING TO SCHOOLS
AN OVERVIEW

By: Walt Westrum, Hall High School District #502, Spring Valley, IL

Ladies and Gentlemen, I am grateful for the opportunity to discuss some rather unique developments in the use of television to help educate young people. They are unique for two reasons. The first is that these developments have made it possible to use the technology of television satellites in space to bring instructional television and important events, from various locations to classrooms in one quarter of the earth simultaneously. The second is that educational organizations and agencies that never before could afford to use television as a tool to bring their ideas to schools now find a variety of options open to them at affordable levels.

Public television broadcasting has done, and continues to do, a tremendous service for schools by providing thousands of instructional programs to schools on regular, over-the-air television and through instructional television film and video libraries located in each state. By using television satellites to deliver films on video formats to various state-level film libraries and cooperatives for a fee, public broadcasting has made it possible for schools to use more instructional programs than they might otherwise be able to afford. At a private level, teachers, likewise. are able to record programs from public television stations over the air at home, bring them to school, and play them back their classes in direct face-to-face teaching situations.

Over-the-air public television and cooperative film libraries, however, no longer provide the only avenues for instructional television. "Dish" antennas have proliferated around the country at schools because they are as inexpensive to purchase as personal computers and potentially can serve many more students on a daily basis. Also, in an age of high technology expectations for schools, they make it possible for schools to receive ITV programs directly from television satellites.

The question of whether "dish" antennas are legal is now moot. Recent federal law has insured the right of the public at large to view unscrambled programs by satellite, and now requires that programmers negotiate rates for various forms of pay television. Such legislation has caused concern among educational television programmers, but also new challenges to work out arrangements that will not only meet new needs by schools, but also open new avenues for profitability. Educational pay TV and compensated instructional television may soon become commonplace nationally to meet the demands of a burgeoning direct satellite to schools television market.

Teachers are finding out that they can make their own AV aids from public domain and near-public domain programs not intended to be instructional. They are finding that recorded video segments, just as printed experts can enhance their teaching if properly used. These include use of space-related events, video teleconferences, foreign language programs, product commercials, parliamentary proceedings, and programs whose programmers currently show little interest in regulating for secondary instructional applications. The largest involvement by teachers in promoting that concept was witnessed in a monitoring exercise of the Teacher In Space mission by satellite called "Mission Watch." It was a joint project of NASA and Classroom Earth, an

association of schools with a capability of using satellite signals for instructional purposes, either by "dish" or TV cable.

TEACHER IN SPACE "MISSION WATCH"

An estimated 2.5 million young people from all fifty states in the U.S. and locations in Canada took part in the "Mission Watch" for the 51-L Teacher in Space shuttle mission. Unfortunately. it was not the celebration of teaching and learning that it was planned to be. The event came to a climatic and horrific close just 73 minutes into the launch with the explosion of the vehicle and the deaths of all seven astronauts on board.

What was planned was a nearly two-week long agenda of activities. From Wednesday of the week preceding Teacher In Space through the day of the shuttle launch, a space watch for the Voyager II spacecraft was already in progress. Voyager II's imaging cameras relayed information from above the surface of the planet Uranus back to earth, a distance in excess of 2 billion miles. Hourly reports were received each day via the NASA Select channel on the Satcom IIR satellite. On Friday morning, Barbara Morgan, the runner up for Teacher In Space greeted students on TV by satellite, telling students and teachers to get ready for Teacher In Space.

Two weeks prior to the launch of Challenger, a one-hour educator's orientation program had been held to explain the scope of "Mission Watch", the activities that would be performed during the flight, and the two "live" lessons from space which were to be carried on PBS for the public at large. Barbara Morgan and William Nixon, NASA Education Branch Chief and person responsible for the Teacher In Space program, answered questions from students calling in from around the country.

During the orientation, the "Mission Watch" concept was explained. Classroom Earth was coordinating the schools' involvement in the project. They discussed the telephone numbers to call for information and C.E.'s computer bulletin board in Texas. They also discussed how Barbara Morgan would give daily live updates each day of the mission, and how to tie into NASA's computer for information on any schedule changes.

Two pounds of free NASA materials and C.E. newsletters had been mailed out free through Classroom Earth to schools able to watch by satellite. These included booklets detailing the events, drawings of the inside of the shuttle, a full-color photograph of Christa McAuliffe and Barbara Morgan, color orbital maps for the 51-L shuttle mission. a color Teacher In Space poster and miniature stick-on emblem, NASA press releases, Classroom Earth newsletters with "hotlines" to call, and an 800 number to inquire about how to get a dish lined up for the watch.

Video of what was to have been an exaltation of the teaching and learning process turned out to be a record of tragedy. The event, witnessed by over 2 million school children as it was happening on the NASA contract as part of the mission watch and millions of others shortly thereafter on videotape on regular broadcast and cable TV, became a classic lesson in the unanticipated outcome--perhaps one of the most striking lessons children will ever again have in school.

"Mission Watch" is expected to continue, although no formal statement to that effect has been made by NASA as yet. A Teacher In Space program for the

future is expected, as are programs for a Journalist In Space and others. Each "Mission Watch" of the future will test the concept that students and teachers are eager to monitor important events that cannot be justified financially on network television or public television. Classroom Earth, wishes to continue to work with NASA on "Mission Watch" programs.

OTHER SOURCES FOR DIRECT SATELLITE VIEWING

Satellite television has become an alternative form of direct communication for and between schools. It is a new instructional technology when compared with the success of computers in schools. But it is growing. Here are some major samples of what satellite television is providing schools at present. It is not intended to be a complete listing of all services currently available.

A variety of teleconferences have been held by the National Diffusion Network, an agency of the U.S. Department of Education. The NDN seeks to provide teachers with instructional packages that have been developed over the years in large part with federal dollars. A series of quality programs are developed each year through the Office of the Kansas State Facilitator.

A new Canadian effort, Young Canada Television, will begin in May, 1986, funded by $22 million Canadian dollars to bring programming of largely Canadian content across Canada. At the present time, Young Canada Television is interested in having south of the border viewers and possibly some bi-national programs. Its use, however, will be limited to those schools with higher frequency rigs than those now in common use in the U.S.

The largest instructional television agency in Canada, TV Ontario, provides cable companies in Canada with educational programs on a basis similar to that of the Public Television Network, but with an emphasis on providing schools with direct curriculum support. TV Ontario has not been too eager for U.S. reception of their programming, except through state agency purchases of rights. It also operates on a frequency other than that used by most dishes in the U.S.

At the present time, Alaska possesses the most sophisticated state network of electronic communication to schools in the U.S. Viewers with satellite dishes on the west coast of the United States are able to look in on the Learn Alaska Network beamed out of Anchorage, Alaska on Satcom V. Learn Alaska provides dual language (English and Innuit) instructional television of a general nature and those with special Alaskan content to its citizens, who, until recently were isolated from the rest of the U.S. The network provides curriculum guides for Alaskan schools only on written request.

The Cable Satellite Public Affairs Network (C-Span) provides daily coverage of the House of Congress, congressional hearings and other items of interest in and around Washington, D.C. For a fee, it provides schools with a tabloid newsletter that explains what meetings are scheduled for various dates and times. The House of Commons channel in Canada provides dual language, French as well as English, coverage of the events of parliament in Ottawa, Ontario. Viewers in the U.S. are able to compare not only the forms of government, but also the style and form of debates.

The Canadian Broadcasting Corporation (CBC) has programs on Anik satellites which are not scrambled (private Canadian services are) which are intended for

Canadian audiences in the east, west and north of Canada. Three languages are used, English, French. and Innuit (Eskimo) plus closed captioning for the hearing impaired on many of their programs. International agreements provide for a 250 mile zone on both sides of the border for access to Canadian and U.S. television. (While regulations exist to complicate reception below that zone in the U.S., no serious concerns on the Canadian side have developed over our citizens watching their programs, but they appear to have some reservations about Canadians watching too much U.S. television for reasons of preserving a separate Canadian cultural identity among Canadians.)

Another foreign language source for schools is the Spanish International Network (SIN) provides 24 hour programs on satellite from New York City. It re-transmits program feeds from various countries in South America, though mainly from Mexico, but also adds program content from Spanish speaking areas of the U.S. The network seeks to be a voice for Spanish culture within the United States and pursues an aggressive cable television marketing plan. It is aware of the interest of schools and provides viewing schedules by mail on written request without charge.

Finally, for the sake of brevity, there are a variety of teleconferences that occur for special purposes between schools, such as one recently that took place between Minneapolis and the Soviet Union, and others that have a reason to want to define a narrow viewer base. University consortia of various kinds, some with their own production and marketing arrangements have been using the satellite airwaves, both scrambled and unscrambled for several years.

In conclusion, there appears to be a need for a central clearing house to advertise programs, especially events, that could provide teachers and students with enriched experiences via television. No medium apart from satellite television, either received by "dish" antennas at the school site, or provided by cable television companies, can bring events and students together in real time as can satellite television.

In the years to come. the needs for quality programming and events by satellite will increase. It is important that school administrators are aware of the new challenges and opportunities posed by this new technology for schools.

COMPUTERIZING THE DISCIPLINE AND ATTENDANCE OFFICE

By: David F. Wooten, Aurora West High School, Aurora, IL

West Aurora High School has an enrollment of about 2600 students. Discipline is handled by two Deans, a Dean's Assistant and a secretary. Attendance is monitored by three secretaries and the Assistant Principal.

Generally three to sixteen suspensions are processed each day with five being the average. To comply with the state law and school board policy, each letter notifying parents of the suspension contains approximately twenty-two unique fields of information that must be merged with a shell suspension letter. Prior to using a computer, a secretary typed the unique information into the shell letter. Because the length of information needed to fill each blank varied from letter to letter, it was necessary to leave large gaps. The result was a letter that satisfied the requirements, but looked very unprofessional. Additionally, by the time copies were made, each letter was taking about ten minutes of secretarial time. On a day of ten suspensions, 1.6 hours were spent on generating letters. Using the computer the same task now takes about ten to fifteen minutes. Although an accurate filing system was maintained under the old system, there was no easy way to extract information such as the average number of suspension days for a particular offense or the number of suspensions issued over a given time period.

The requirements were to provide a system that would:

1. Merge twenty-two fields of information into a letter.
2. Produce six copies of the letter.
3. Save time.
4. Allow tracking for number of suspensions, total number of days, and average number of days by reason, dean, counselor, sex, and ethnic group.
5. Be easy to use with a minimum of training.
6. Work with an Apple IIe computer.

SYSTEM SELECTION

Several programs were investigated, but only the combination of PFS:File and Report and Word Juggler filled all requirements. Once the data is entered into the file only three keystrokes are necessary to generate the letters, whereas other systems, such as Appleworks, necessitate printing an ASCII file to the disk with the filing program then going into the word processor or special mailing program to generate the letters. Note that Word Juggler was selected, but PFS: Write can also be used, though at a sacrifice of speed and some advanced features.

WORD PROCESSING SYSTEM OPERATION-SUSPENSION LETTERS

1. Discipline referral comes to the dean who decides on the consequence. If suspension is given, a summary card is filled out by the dean.

2. Summary card is given to the discipline secretary who fills out a PFS: File screen. This occurs sometime prior to 2:55 P.M. at the secretary's convenience.

3. At 2:55 P.M., when no more suspensions will be processed, the secretary boots Word Juggler and loads in the special suspension letter.

4. The month and date are changed in the beginning of the letter then the forms processing keys are pressed.

5. The secretary goes about other tasks until the printer is done printing.

6. The letters are sent to the appropriate people.

SPECIAL FEATURES OF SUSPENSION LETTER SYSTEM

Word Juggler provides special logic functions that enable several variations of a form letter to be printed automatically depending on the type of suspension being processed. For example, our standard suspension letter tells the parent when the student may return to school. A letter for a suspension that has expulsion as a possibility obviously should not tell the student to return to school. At the current time, Aurora West High School has four different types of suspensions that require special phrases to be inserted into the letter. 1) Regular suspension, 2) Out of School Suspension plus Bus Suspension. 3) Suspension due to substance abuse and 4) Suspension and possible Expulsion.

FILING SYSTEM, LETTERS AND REPORTS

1) Out of School Suspensions
   Letter: Inform parents of details of suspension
   Reports:
   a.) Daily list of students on suspension
   b.) Monthly report - number of suspensions, total days
   c.) Monthly report broken down by suspending administrator to include total days, average number of days, and number of suspensions
   d.) Monthly year to date suspensions alphabetized by student including number of days and reason per student
   e.) Semi-monthly report alphabetized by student of particular reasons for suspension such as fighting
   f.) End of year report on suspensions by ethnic group and sex

2) In School Suspensions
   No letter
   Reports:
   a.) Monthly year to date report alphabetized by student, including number of days and reason per student
   b.) Monthly report alphabetized by student for particular reasons

3) Parking Permits
   No letter
   Reports:
   a.) Alphabetical list of students with permits
   b.) List in parking sticker numerical order
   c.) List in license plate numerical order

4) No Trespassing
   Letter: Tells the person they are not to be on school grounds or police will be called.
   Reports: List of all people receiving no trespassing letter distributed to all campus monitor personnel.

5) Student Failure Due to Attendance
   Letter: Inform parents that a student has twenty or more absences and by policy will fail class
   Reports: List of students to send to teachers to verify absentee records.

ATTENDANCE PROCEDURES

Master attendance files and reports are generated by a mainframe computer system maintained in the district's administrative office. Information is accessible to the attendance office by using a terminal linked to the main computer. Excused absences are based on parent calls received by 5:30 P.M. the previous day. At present the mainframe is not able to supply a list of these students for teacher use by the next morning so the attendance office types the list and distributes it. A special program written at the high school is used to produce an alphabetized three column list divided into four categories of student absence: excused, in school suspension, out of school suspension, and homebound. Any student not on the list must get a pass from the attendance office before being readmitted to class.

SYSTEM EVALUATION

As in most cases when office procedures are computerized, a reduction in staff has not occurred, but rather the time saved to accomplish routine tasks has been used to enter and analyze data that was previously largely ignored. This has enabled the discipline office to identify problems with certain behaviors and consequences and make necessary changes. The key element of a computer assisted discipline office is the analysis of data. The result of this process is a more efficient and effective school discipline policy.

SYSTEM REQUIREMENTS

Hardware: Apple IIe - 80 column (128K desirable, but not necessary)
Two disk drives (5.25 inch)
Printer

Software: Word Juggler by Quark
Price: $99.00
PFS: File and Report by Software Publishing
Price: $90.00 each

APPENDIX CONTENTS

a. Forms - Suspension. In School Suspension, and Parking
b. Suspension letter (non-printing control codes enclosed in [], personalized information enclosed in <>.
c. Alternative to suspension letter
d. Daily suspension report
e. Sample monthly suspension report by student
f. Sample monthly suspension report by dean
g. Sample cumulative suspension report for fighting
h. Sample male suspension report by ethnic group
i. Sample no trespassing letter

APPENDIX A-SAMPLE

Last Name: Wooten First Name: David I.D.: 880234

Title: Mr. Parent First: John Parent Last: Wooten

Address: 117 Spruce Street

City: Aurora State: IL ZIP: 60506

Month: February Day: 12 Year: 1986

Descriptor: Bus Paragraph: B.01

Reason: Fighting on school bus
Reason 2:

Date(s): 02/11-14 Days: 3
Return Date: 02/18/86 Adm. Name: D. Wooten

Counselor: Wallbaum Ext: 4665 Adm. Title: Asst. Principal

Teacher: Ethn: 3 Sex: M

Student.Last: Student.First:

Ethnic.Code: Sex:

Reason:

Number.of.days:

Parking Permits

Last Name:

First Name:

Permit Number:

Issue Date:

Vehicle Make and Model:

Year of Vehicle:

License Plate Number:

Violation 1 Date:

Violation 2 Date:

Violation 3 Date:

APPENDIX B EXAMPLE

[If]
<Month> = "January" & <Day>="27"
[10 Pitch]
[Width 70]
[Length 60]
[Top Margin 5]
[Left Margin 5]
[Center]
Aurora West High School 1201 W. New York St. Aurora, IL 60506
[Ragged Right]

<Title> <Parent.First> <Parent.Last>
<Address>
<City>, <State> <ZIP>
<Month> <Day>, <Year>

Dear <Title> <Parent.Last>:

It is with regret that I hereby officially notify you that <First.Name> <Last. Name> has been suspended from Aurora West High School. This suspension is for a period of <Days> days, <Date(s)>. <First.Name> is to return to school at 8:00 A.M. on <Return.Date>. During the period of suspension, it is strongly recommended that <First.Name> remain at home, under your supervision, during school hours, 8:00 A.M. - 3:00 P.M. <First.Name> will not be allowed on school grounds or at school activities at any time during the suspension.

REASON FOR SUSPENSION: **<Reason> <Reason2>**

The above misconduct is in violation of School District #129 Student Conduct Code and Board of Education Policy, Article II, <Paragraph>. This behavior will not be tolerated at school as it interferes with the educational program of your student and of other students in our school.

[If]
<Descriptor>="Bus"
Additionally, <First.Name> will be suspended from bus privileges for <Bus.Days> days, <Bus.Dates>. On these dates <First.Name> will have to find alternate transportation.

[End If]
[If]
<Descriptor>="S.and.E"
Please be advised that the Administration is giving consideration to recommending that <First.Name> be expelled from school for a significantly longer period of time than is provided for in this suspension. If such a recommendation is forthcoming, you will be advised in writing, by the Superintendent of Schools, as to the date, time and place of the expulsion hearing.

[End If]
You may have this suspension reviewed by the Board of Education before a hearing officer. Aurora West Principal, Thomas Madden, must be advised of your desire for a review within five days of the receipt of this letter.

APPENDIX B EXAMPLE CONTINUED

[If]
<Descriptor>="FREE" : <Descriptor>="" : <Descriptor>="Bus"
For <First.Name> to be reinstated to school on <Return.Date>, you and <First. Name> must meet with the counselor, <Counselor>. Call 844-<Ext> to make the necessary arrangements.
[End If]

Sincerely,
<Adm.Name>, <Adm.Title>
Aurora West High School

cc: D. Jones, Asst. Supt.
T. Madden, Principal
<Adm.Name>, <Adm.Title>
<Counselor>, Counselor
D. Voirin Police Counselor
[New Page]

APPENDIX C EXAMPLE

[If]
<Descriptor>="FREE"

BREAKING FREE:
AN ALTERNATIVE TO FULL SUSPENSION PROGRAM

Students involved in a school related drug or alcohol incident are, according to school policy, subject to a ten day out of school suspension. As an alternative to the full ten day suspension, West Aurora and Breaking Free Incorporated offer a series of educational workshops to students and their parents. "Breaking Free" is conducted by professionals who counsel with parents and children alike to educate both about the effect of substance abuse.

Students choosing to participate in the suspension alternative will have their suspension reduced. It is the responsibility of the families to contact "Breaking Free", within the first three days of the suspension, and make arrangements to attend the alternative program. "Breaking Free" has an $80 fee which is variable depending on each case. A worker from "Breaking Free" will notify the school of <First.Name>'s enrollment in the program.

It is important to note that "Breaking Free" will also notify the school if you and <First.Name> arrange to attend the program but do not complete all of the sessions. At that point, <First.Name> will be suspended for the remainder of the original 10 day suspension.

For further information call: Breaking Free, Inc., 250 West Downer Place, Aurora, IL 60506 (312) 859-0670

Sincerely,
<Adm.Name>
<Adm.Title>
Aurora West High School
Aurora, IL 60506
(312) 844-4672

[End If]
[End If]

APPENDIX D EXAMPLE

Students On Suspension 2/11

Last Name	First Name	Date(s)	Days	Return Date
And	Bernard	02/03-17	10	02/18/86
Br	Jason	02/10,11	2	02/13/86
Carr	Ted	02/10,11	2	02/13/86
Dav	Rosemary	02/11	1	02/13/86
Gra	Sean	01/31-02/11	8	02/13/86
Hu	Larry	02/11	1	02/13/86
Jon	Jennifer	02/10,11	2	02/13/86
Loc	Lydia	02/11,13,14	3	02/17/86
Mira	Theresa	02/10-13	3	02/14/86
Mitch	Tricia	02/07-11	3	02/13/86
New	Ellen	02/04-02/11	6	02/13/86
Port	Anabel	02/10-13	3	02/14/86
Wayc	Nancy	02/07-21	10	02/24/86
Well	Kerry	02/10-13	3	02/14/86
Wier	Theresa	02/07-11	3	02/13/86
Will	Ray	02/11s	1	02/13/86

APPENDIX E EXAMPLE

February OSS by Student Name

Last Name	First Name	Days	Paragraph
And	Bernard	10.0	B.9,12
Bac	David	3.0	B.04
Ban	John	1.0	B.12
Ben	Elizabeth	3.0	B.12
Bro	Jason	2.0	B.01
Cah	Ken	1.0	B.11
Carr	Ted	2.0	B.07
Chap	Domingo	1.0	B.04
Clay	Ed	1.0	B.12
	James	1.0	B.12
Conl	Bernie	1.0	B.12
Cont	Carlos	1.0	B.12
Davi	Rosemary	1.0	B.12
Dlug	Mary Jo	3.0	B.12
Flor	Johnny	1.0	B.12
Harr	Chuck	1.0	B.12
Hern	Max	3.0	B.12
Huf	Larry	1.0	B.12
Jack	Jay	3.0	B.12
Jenk	Erik	3.0	B.12
Jon	Jennifer	2.0	B.04
Keier	Laura	3.0	B.12
Loc	Lydia	3.0	B.04
Lop	David	5.0	B.04,11.12
Mir	Theresa	3.0	B.10,11,12
Mitch	Tricia	3.0	B.01
New	Ellen	6.0	B.01,10,11,12
Ort	Juan	3.0	B.12
Port	Anabel	3.0	B.12,18
Prea	Aaron	4.0	B.01,12
Pri	Mike	2.0	B.9,12
Rog	Anthony	4.0	B.12,13
Shen	Patty	3.0	B.04,12
Way	Nancy	10.0	B.09,10,11,12
Wel	Kerry	3.0	B.12,19
Wierz	Theresa	3.0	B.01
Will	Ray	1.0	B.12
Woot	David	3.0	B.01
Wor	Brad	2.0	B.10,11,12
	AVERAGE:	2.7	
	TOTAL:	109.0	
	COUNT: 39	39	

APPENDIX F EXAMPLE

February OSS by Dean

Adm.Name	Last Name	First Name	Days	Paragraph
D. Wooten	Wooten	David	3.0	B.01
		AVERAGE:	3.0	
		TOTAL:	3.0	
		COUNT:	1	
L. She	And	Bernard	10.0	B.9,12
	Bac	David	3.0	B.04
	Ban	John	1.0	B.12
	Ben	Elizabeth	3.0	B.12
	Bro	Jason	2.0	B.01
	Cah	Ken	1.0	B.11
	Carr	Ted	2.0	B.07
	Cha	Domingo	1.0	B.04
	Clay	James	1.0	B.12
		Ed	1.0	B.12
	Con	Bernie	1.0	B.12
	Cont	Carlos	1.0	B.12
	Dav	Rosemary	1.0	B.12
	Dlug	Marv Jo	3.0	B.12
	Flor	Johnny	1.0	B.12
	Harr	Chuck	1.0	B.12
	Hern	Max	3.0	B.12
	Huf	Larry	1.0	B.12
	Jack	Jay	3.0	B.12
	Jenk	Erik	3.0	B.12
	Jon	Jennifer	2.0	B.04
	Kei	Laura	3.0	B.12
		AVERAGE:	2.1	
		TOTAL:	48.0	
		COUNT:	22	
R. Th	Lo	Lydia	3.0	B.04
	Lop	David	5.0	B.04,11,12
	Mir	Theresa	3.0	B.10,11,12
	Mit	Tricia	3.0	B.01
	New	Ellen	6.0	B.01,10,11,12
	Ort	Juan	3.0	B.12
	Port	Anabel	3.0	B.12,18
	Pre	Aaron	4.0	B.01,12
	Pri	Mike	2.0	B.9,12
	Rog	Anthony	4.0	B.12,13
	Shen	Patty	3.0	B.04,12
	Way	Nancy	10.0	B.09,10,11,12
	Wel	Kerry	3.0	B.12,19
	Wier	Theresa	3.0	B.01
	Wil	Ray	1.0	B.12
	Wor	Brad	2.0	B.10,11,12
		AVERAGE:	3.6	
		TOTAL:	58.0	
		COUNT:	16	
AVERAGE:	2.7			
TOTAL:	109.0			
COUNT:	39			

APPENDIX G EXAMPLE

Jan-Feb OSS for Fighting

Last Name	First Name	Days	Paragraph
And	Bernie	5	B.01
	Shawn	3	B.01
Bro	Jason	2	B.01
But	Jerry	3	B.01
Byw	Mike	3	B.01
Cla	Jeff	4	B.01,11,12
Co	Randy	3	B.01
Di	Samantha	3	B.01
Dom	Josefina	2	B.01
Hae	Eric	2	B.01
Her	Ron	5	B.01,12
Law	Joella	10	B.01,9,11
Mil	Jason	5	B.01,12
Mit	Tricia	3	B.01
New	Ellen	6	B.01,10,11,12
Par	Russell	4	B.01
Pre	Aaron	4	B.01,12
Rodr	Abel	4	B.01,10.11,12
Rou	Heather	2	B.01
Spr	David	2	B.01,11
Ste	Mike	2	B.01
Stu	Bryan	2	B.01
War	Gene	2	B.01,9,11
Way	Nancy	10	B.09,10.11,12
Wier	Theresa	3	B.01
Woo	David	3	B.01
	AVERAGE:	3	
	TOTAL:	97	
	COUNT: 26	26	

APPENDIX H EXAMPLE

2/86 Male OSS by Ethnic Group

Ethn	Last Name	First Name	Days
2	And	Bernard	10.0
	Bac	David	3.0
	Bro	Jason	2.0
	Cah	Ken	1.0
	Huf	Larry	1.0
	Jen	Erik	3.0
	Pre	Aaron	4.0
	Pri	Mike	2.0
	Rog	Anthony	4.0
	Wil	Ray	1.0
		AVERAGE:	3.1
		TOTAL:	31.0
		COUNT: 10	10
3	Bana	John	1.0
	Carr	Ted	2.0
	Cla	Ed	1.0
		James	1.0
	Con	Bernie	1.0
	Har	Chuck	1.0
	Jac	Jay	3.0
	Woo	David	3.0
	Wor	Brad	2.0
		AVERAGE:	1.6
		TOTAL:	15.0
		COUNT: 9	9
4	Cha	Domingo	1.0
	Cont	Carlos	1.0
	Flor	Johnny	1.0
	Hern	Max	3.0
	Lop	David	5.0
	Ort	Juan	3.0
		AVERAGE:	2.3
		TOTAL:	14.0
		COUNT: 6	6
		AVERAGE:	2.4
		TOTAL:	60.0
		COUNT: 25	25

APPENDIX I EXAMPLE

AURORA WEST HIGH SCHOOL 1201 W. NEW YORK ST. AURORA, IL 60506

<Date>

<Title> <First.Name> <Last.Name>
<Address>
<City>, IL <Zip>

Dear <Title> <Last.Name>:

This letter will serve as notification that your presence on the property of West Aurora High School is expressly forbidden. Please be advised that our objective is to avoid problems from developing on our campus.

The following is cited from the Illinois Revised Statutes, 1961 Chapter 38-Criminal Code:

> "Article 21-3, Criminal Trespass to Land:
> (a) Whoever enters upon the land or any part thereof of another after receiving, immediately prior to such entry, notice from the owner or occupant that such entry is forbidden, or remains upon the land of another after receiving notice from the owner or occupant to depart, shall be fined not to exceed $100 or imprisoned in a penal institution other than the penitentiary not to exceed 10 days.
>
> (b) A person has received notice from the owner or occupant within the meaning of subsection (a) if he has been notified personally, either orally or in writing, or if a printed or written notice forbidding such entry has been conspicuously posted or exhibited at the main entrance to such land or the forbidden part thereof."

Violation of this notification will result in legal action.

Sincerely,

David Wooten
Assistant Principal

DW/pb

WRITER'S HELPER

By: William Wresch, University of Wisconsin, Stevens Point, WI

Writer's Helper is a set of 22 programs to help high school and college students organize their ideas for writing and evaluate the quality of their work. The program runs on Apple and IBM computers (and IBM compatibles), and works with most standard word processors.

The first group of programs in Writer's Helper are the prewriting programs intended to help students find ideas to write about, explore those ideas, and organize their ideas prior to writing. Here are the programs available:

Find a Subject:
- Brainstorms
- Lists
- The Questioner

Explore a Subject:
- Crazy Contrasts
- Teacher's Questions
- Three Ways of Seeing

Organize Information:
- Trees
- Debating an Issue
- Comparing and Contrasting
- Five-Paragraph Theme
- Develop One Paragraph

Students are free to choose whichever program they feel they need to get started with their writing. For instance, a student who needed help in selecting a subject might use the "Brainstorms" program to do some freewriting. The alternative programs are "Lists" which helps student work through lists of ideas and create blocks of information about a topic, and "The Questioner" which prompts students with twenty questions like "What do you like most about your school?"

If students have a subject in mind, or have been assigned a subject by their teacher, they can try to develop their ideas about the subject by using "Crazy Contrasts," a program which stretches their thinking about a subject by asking them to compare the subject to something unusual. For instance, if their subject were "women's athletics," the program might ask them:

"List three ways women's athletics is like a chocolate sundae."

For students who like more traditional exploration, there is "Teacher's Questions," which is a list of questions supplied by their teacher to go with the current assignment, and "Three Ways of Seeing," which asks 12 to 14 questions about their subject as it exists in isolation, as it changes over time, and as it relates to similar subjects.

If students have a firm hold on their subject and are ready to start thinking about how to order their ideas, they can choose one of four modules which show them how to group their ideas ("Trees"), how to set up an argument ("Debating

an Issue"), how to compare subjects ("Comparing and Contrasting"), or how to do a standard five paragraph theme. In each case the students answer a set of questions and are supplied with a resulting sentence outline for their theme.

All of the work that students do in these prewriting programs can be saved onto a disk and transferred to a standard word processor. Once there, the information collected during prewriting can serve as the basis for the theme itself.

After students have written a draft or two of their work, they can use the Analysis portion of Writer's Helper to help them proofread and edit their work. There are 11 Analysis Modules:

Outline
Count Words in Paragraph
List Document by Sentences
Readability Index
Count Words in Sentences
Check for Homonyms
Check for Gender-Related Language
Check for "to be" verbs
Check for Usage Errors
Word Frequency Count

About half of the analysis modules will find errors for students directly, while the other half help students proofread by reformatting the text. Modules that look for errors directly are "Check for Homonyms," which catches forty common confusions, "Gender-Related Language," which looks for common mistakes like "chairman" and such, and "Usage Errors," which picks up standard examples of trite phrasing and usage confusions.

Many of the programs leave proofreading up to the student, but try to help by reformatting the text so errors are easier to see. A standard example is "List Document by Sentences," which displays one sentence at a time so students can more easily spot fragments and run-ons. "Outline" displays the first sentence of each paragraph so students can see if there is a coherent development to their paragraphs. "Word Frequency Count" lists each word used in an essay and the number of times it was used. Students can use this information to see if they are over using particular words.

Ultimately, the purpose of all the Analysis Modules is to give students a tool to use in improving their writing, a tool which gives them the ability to correct many simple errors before a teacher has to. The tool should help students become more independent.

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